Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

SIMPSON 260® SERIES 6 AND 6M VOLT-OHM-MILLIAMMETERS

260® Is a Registered Trademark of The Simpson Electric Company

WARNING

For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
In Canada, Bach-Simpson, Ltd., London, Ontario

Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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ELECTRICAL EQUIPMENT GROUP

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NOTE

This Operator's Manual contains information essential to the operation of this Instrument. Therefore, it should be kept with the Instrument at all times and not misplaced or discarded.

SAFETY SYMBOLS

This marking adjacent to another marking or a terminal or operating device indicates that the Operator must refer to an explanation in the Operating Instructions to avoid damage to the equipment and/or to avoid personal injury.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the Instrument.

WARNING

These Instruments are designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely prior to making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson Model 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with the 260-6 1mA range and use this as the measuring instrument.

Figure 1-1. Simpson 260-6 Volt-Ohm-Milliammeter

Figure 1-2. Simpson 260-6M Volt-Ohm-Milliammeter

SECTION I
INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson Volt-Ohm-Milliammeters 260 Series 6 and Series 6M (hereafter referred to as the 260 or as the Instrument), are identical instruments electrically and mechanically, except that the Series 6M is equipped with a mirrored dial to eliminate parallax (Figures 1-1 and 1-2). The 260 Series 6 is a rugged, accurate, compact, easy-to-use instrument. The Instrument can be used to make accurate measurements of DC and AC voltage, direct current, resistance, decibels, and output voltage. The output voltage function is used for measuring the AC component of a mixture of AC and DC voltage. This function occurs primarily in amplifier circuits.

1.1.2 The 260 Series 6 has the following new features: a 0-1 volt DC range, 0-500 volt DC and AC ranges, a TRANSIT position on the range switch, rubber plug bumpers on the bottom of the case to reduce sliding, improved test leads and an externally accessible battery and fuse compartment. Batteries and one amp fuse can be changed quickly by loosening the single screw of the compartment cover located on the bottom of the case.

1.1.3 To complement the circuit accuracy, the 260 features a new taut-band, annular movement. The annular movement provides self-shielding, and the taut-band suspension provides a high degree of repeatability and is highly resistant to damage by shock or vibration.

1.1.4 Several internally located calibration circuits are provided to increase the initial accuracy of the 260 and to facilitate recalibration should it become necessary.

1.1.5 The 260 uses the most modern components and circuit techniques. It is assembled by well-trained personnel using quality

materials and modern equipment. This combination of design, materials, and skillful assembly results in a unit that will take considerable abuse and still provide accurate indication. If it is kept clean and is not unduly abused or misused, or subjected to extreme shock or vibration, the 260 will give many years of trouble-free service.

1.2 DESCRIPTION

1.2.1 Phenolic Case

1.2.2 The phenolic case is designed with heavy reinforced walls for maximum durability and provides excellent protection for the circuit components. The case has an externally accessible battery and fuse compartment. Access to the batteries and one amp fuse is obtained by unscrewing a single captivated screw at the bottom of the case and sliding out the compartment cover. (A spare fuse is also provided in the compartment.) Rubber plug bumpers on the bottom of the case reduce sliding should the Instrument be accidentally pulled by the test leads when it is on a workbench.

1.2.3 Printed Circuit

1.2.4 Most of the component parts are mounted on a printed circuit board which simplifies assembly and maintenance, thus extending the useful life of the Instrument.

1.2.5 Test Leads

1.2.6 Each Instrument is furnished with one pair of (Cat. No. 00125) test leads 4 feet long. One lead is black and the other red for easy polarity identification. The test lead wire consists of a large number of fine strands and is very flexible. The insulation of the wire is more than adequate for the highest voltage that the Instrument will measure. The red and black test leads have probe tips which are threaded near the base. The alligator clips may be screwed on or off either test lead to provide a probe or a clip for the operator's convenience (Table 1-2).

1.2.7 Fuse Protection

1.2.8 A 1-ampere 250-volt and a 2-ampere 600-volt high capacity fuse (1000A) are provided to protect the 260 low impedance circuits from misuse on the Ohm and Current ranges. The 1-ampere fuse is used for normal overload conditions, and the 2-ampere fuse is connected in series with the 1-ampere fuse as a protection against excessive high energy overloads applied to current or ohms ranges.

1.2.9 For maximum protection it is important to replace the 1A fuse with a Littelfuse type 312001 only. This will allow the combination of 1A and 2A BBS/KTK fuse to give maximum protection to the unit and the user under overload conditions which may occur within the measuring capability of the VOM.

1.2.10 If the instrument fails to indicate, the 1 Amp or the 2 Amp fuses may be burned out. (Refer to Paragraph 5.3 for fuse replacement.) A 1 Amp spare fuse is furnished with each Instrument. Both 1 Amp fuses are located in the battery and fuse compartment. The 2 Amp fuse is located on the instrument panel under the printed circuit board.

1.2.11 Movement Overload Protection

1.2.12 In addition to the fuse, a varistor protects the indicating Instrument circuit. The varistor limits the current through the moving coil in case of overload.

CAUTION

The fuses and varistor will prevent serious damage to the 260 in most cases of accidental overload. However, no fuse protection system is completely foolproof;therefore, any misapplication on high voltage circuits can still damage the Instrument. Also, care should always be exercised to set the switches and connect the leads properly and to avoid overload conditions.

1.3 TECHNICAL DATA

1.3.1 Table 1-1 lists the technical data for the 260-6 and 6M (RT).

Table 1-1. Technical Data

1.	DC VOLTS:	
	Ranges:	0-1-2.5-10-50-250-500-1000V
	Sensitivity:	20,000 ohms per volt
2.	DC MILLIVOLTS:	
	Range:	0-250mV
	Sensitivity:	20,000 ohms per volt
3.	AC VOLTS:	
	Ranges:	0-2.5-10-50-250-500-1000V
	Sensitivity:	5,000 ohms per volt
4.	OUTPUT VOLTAGE (AC):	
	Ranges:	0-2.5-10-50-250 (limited to 350 VDC)
5.	DC MICROAMPERES:	
	Range:	0-50μA
	Voltage Drop:	250 mV
6.	DC MILLIAMPERES:	
	Ranges:	0-1-10-100 -500 mA
	Voltage Drop (Approx.):	250 mV, 250 mV, 280 mV, 400 mV
7.	DC AMPERES:	
	Range:	0-10A
	Voltage Drop (Approx.)	250 mV

8. RESISTANCE:

	R × 1	R × 100	R × 10,000
Range	0-2,000Ω	0-200,000Ω	0-20 MΩ
Center Reading	12Ω	1200Ω	120,000Ω
Nominal Open Circuit Voltage	1.5V	1.5V	9V
Nominal Short Circuit Current	125 mA	1.25 mA	75μA

9. *ACCURACY:

DC Voltage Ranges: 2% of Full Scale
DC Current
0-50 μA Range: 1.5% of Full Scale
Other Ranges: 2% of Full Scale
**AC Voltage Ranges: 3% of Full Scale
Frequency Response: Referenced to 100 Hz (Figures 4-2 and 4-4)

Resistance Ranges:
R×1: 2.5° of Arc
R×100: 2° of Arc
R×10,000 2° of Arc

10. DECIBELS:

Range: —20 to +10 dB, —8 to +22dB, +6 to +36 dB, +20 to +50 dB

Reference Level: With zero dB power level equal to 1 mW across a 600Ω line.

11. BATTERIES:

Voltage: 1.5V, 9V
NEDA No.: 13F, 1604

12. FUSE: F1 1A, 250V, type 3AG, quick-acting Littelfuse Type 312001, F2 2A, 600V, Type BBS or KTK (Bussman)

13.	TEST LEADS:	1 red, 1 black, 48″ long.
14.	SIZE:	5½″ x 7″ x 3⅛″ (13.34 x 17.78 x 7.94 mm)
15.	WEIGHT:	3 lbs. (1.359 kg)
16.	***RATED-CIRCUIT TO-GROUND VOLTAGE:	1000V AC/DC (1500V Peak) Max.

** Accuracies specified are for the 260 in a horizontal position.*

*** Responds to the average value of an AC current, and is calibrated to indicate the rms value of a pure sine wave.*

****Per ANSI C39.5 April 1974: "The maximum voltage, with respect to ground, which may safely and continuously be applied to the circuit of an Instrument."*

1.4 ITEMS AND ACCESSORIES

1.4.1 All items and accessories required for the operation of the 260 are furnished with each instrument, and listed in Table 1-2. (Available replacement parts are listed in Table 6-1.)

1.5 DEFINITION OF ACCURACY

1.5.1 The voltage and current accuracy of this instrument is commonly expressed as a percent of full scale. This should not be confused with accuracy of reading (indication). For example, ±2% of full scale on the 10 volt range allows an error of ±0.20V at any point on the dial. This means that at full scale, the accuracy of reading would be ±2%, but at half scale it would be ±4%. Therefore, it is advantageous to select a range which gives an indication as near as possible to full scale.

1.6 SAFETY CONSIDERATIONS

1.6.1 This Operator's Manual contains cautions and warnings alerting the user to hazardous operating and service conditions. This information is flagged by CAUTION or WARNING headings throughout this publication, where applicable, and is defined at the front of the manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating conditions of the Instrument, these instructions must be adhered to.

Table 1-2. Items and Accessories Furnished With This Instrument

Quantity	Description	Number
1	Test Lead Set-One red and one black (4 ft. long) each with combination probe tip and removable rubber-sleeved alligator clip at one end and banana plug on opposite end.	00125
*1	1.5 volt, D Cell, NEDA 13F	
*1	9.0 volt Cell, NEDA 1604	
1	1 Amp, 250V Fuse, Littelfuse Type #312001	
1	2 Amp, 600V Fuse, Bussman Type BBS or KTK	
1	Operator's Manual	6-110928

**Batteries are standard items replaceable from local retail stores.*

Table 1-3 Additional Accessories

Description	Number
Ever-Redy Carrying Case	00805
Roll-Top Safety Carrying Case	00248
Vinyl Carrying Case	01818
Deluxe Carrying Case	00812

SECTION II
INSTALLATION

2.1 GENERAL

2.1.1 This section contains information and instructions for the installation and shipping of the Simpson 260. Included are unpacking and inspection procedures, warranty, shipping, power source requirements, operating position and care.

2.2 UNPACKING AND INSPECTION

2.2.1 Examine the shipping carton for obvious signs of damage. Inspect the Instrument for possible damage incurred during shipment. If damage is noted, notify the carrier and supplier and do not attempt further use of the Instrument. If Instrument appears to be in good condition, read Operator's Manual in its entirety. Become familiar with the Instrument as instructed in the manual, then proceed to check the electrical performance as soon as possible. Also, check that all items are included with the Instrument (Table 1-2).

2.2.2. After unpacking the Instrument, you will find a 1.5V battery and a 9V battery in separate envelopes in the box with the Instrument and test leads. Two alligator clips for the test leads are in a polyethylene bag. (See Section V for instructions on how to open the battery compartment and install the batteries.)

2.3 WARRANTY

2.3.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

NOTE: For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center for instructions (listed on the last pages of this manual). If it's necessary to contact the factory directly, give full details of any difficulty and include the Instrument model number, series number, and date of purchase. Service data or shipping instructions will be mailed promptly. If an estimate of charges for non-warranty or other service work is required, a maximum charge estimate will be quoted. This charge will not be exceeded without prior approval.

2.4 SHIPPING

2.4.1 Pack the Instrument carefully and ship it prepaid to the proper destination. Insure the Instrument.

2.5 POWER SOURCE REQUIREMENTS

2.5.1 There are two batteries in the ohmmeter circuits. One is a NEDA 13F D size cell that furnishes 1.5 volts for the R $\times$ 1 and R $\times$ 100 ranges. A NEDA 1604 battery furnishes 9 volts for the R $\times$ 10,000 range. The 1.5 D cell is held in place with two spring clips which also serve as battery contacts. The 9-volt battery is held in place with a spring clip but contact is made with

a separate connector that is polarized. (Always observe correct polarity when replacing the 1.5-volt D cell.)

2.6 OPERATING POSITION

2.6.1 A handle is attached to the side of the instrument case. The handle may be used to support the Instrument in a convenient, sloping position for easy viewing. The VOM case can also be placed either in a vertical or horizontal position. The horizontal position is preferable for greater accuracy since the Instrument is calibrated in this position.

2.7 CARE

2.7.1 Immediately clean all spilled materials from the Instrument and wipe dry. If the spillage is corrosive, use a suitable cleaner to neutralize the corrosive action, and remove the spillage.

2.7.2 Whenever the Instrument is not in use, rotate the range switch to the TRANSIT position.

2.7.3 Whenever possible, avoid prolonged exposure or usage in areas which are subject to temperature and humidity extremes, vibration or mechanical shock, dust or corrosive fumes, or strong electrical or electromagnetic interferences.

2.7.4 Monthly Care: Verify Instrument accuracy by performing

operational checks using known, accurate, stable sources. If proper calibration equipment is not available, contact your nearest Simpson Authorized Service Center (refer to last pages of this manual). If the Instrument has not been used for 30 days, check the batteries for leakage and replace if necessary.

2.7.5 Annual Care: It is recommended that the Instrument be returned annually to your nearest Simpson Authorized Service Center, or to the factory, for an overall check, adjustment, and calibration.

2.7.6 Storage: When the Instrument is not in use, store it in a room free from temperature extremes, dust, corrosive fumes, and mechanical vibration or shock. If storage time is expected to exceed 30 days, remove batteries.

SECTION III
CONTROLS, JACKS, AND INDICATORS

3.1 GENERAL

3.1.2 All operating and adjustment controls, jacks and indicators for the Simpson 260 are described in this section along with a list (Table 3-1) describing their function. Become familiar with each item prior to operating the Instrument.

3.2 FRONT PANEL DESCRIPTION

3.2.1 Description of front panel controls, jacks, and indicators is as follows:

NOTE: The item call-out in Figure 3-1 corresponds with the numerical order of the items listed in Table 3-1.

Table 3-1. Controls, Jacks, and Indicators

1. **Front Panel:**	The 260-6 Volt-Ohm-Milliammeter is a large, easy-to-read 4¼ inch indicating instrument. Below the Instrument are four controls and eight circuit jacks. Switch positions and circuit jacks are marked in white characters for easy reading.
2. **Range Switch:**	Has 12 positions: May be turned in either direction. There are 5 voltage positions, 4 direct current positions, and 3 resistance positions used to select desired ranges.
3. **Function Switch:**	The function switch has three positions: —DC, +DC and AC. To measure DC current or voltage, set the

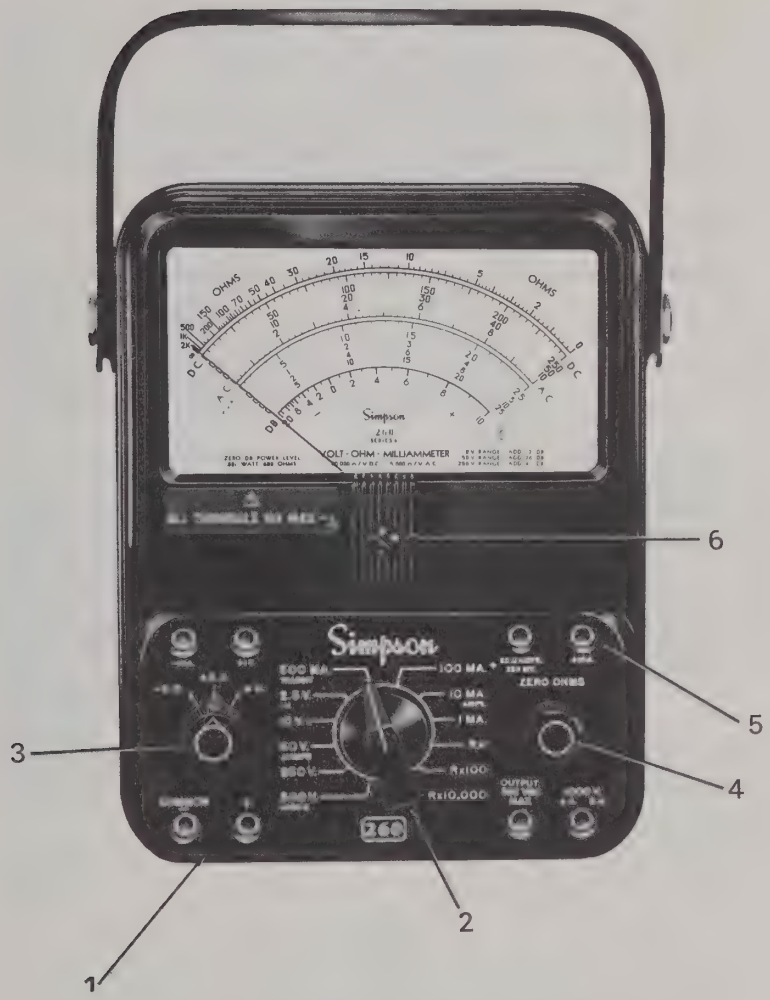

Figure 3-1. Front Panel Controls, Jacks and Indicators

function switch at the —DC or +DC position, depending on the polarity of the signal applied across the test leads. To measure AC voltage set the function switch to the AC position. For resistance measurement, the switch may be set in either the +DC or —DC position. The polarity of the internal ohmmeter battery voltage at the (+) pos jack is identical to the function switch polarity setting and opposite at the (—) common jack.

4. **Zero Ohms:** This control is used to compensate for variation in the voltage of the internal batteries.

5. **Circuit Jacks:** There are eight jacks on the front panel marked with the functions they represent (Figure 3-1). These jacks provide the electrical connections to the test leads. The COMMON (—) jack is used (in conjunction with the black test lead) as the reference point for the measurement of all the functions with the exception of the 10A range. (Refer to the Operation Section for details.)

6. **Pointer Adjust For Zero:** With the Volt-Ohm-Milliammeter in an operating position, check that the pointer indicates zero at the left end of the scale when there is no input. If pointer is off zero, adjust the screw located in the case below the center of the dial. Use a small screwdriver to turn the screw slowly clockwise or counterclockwise until the pointer is exactly over the zero mark at the left end of the scale. With the indicating pointer set on the zero mark, reverse the direction of rotation of the zero adjuster. Rotate the zero adjuster a sufficient amount to introduce mechanical freedom or "play" but insufficient to disturb the position of the indicating pointer. This procedure will avoid disturbances to the zero setting by subsequent changes in temperature, humidity, vibration, and other environmental conditions.

SECTION IV
OPERATION

WARNING

Before proceeding with the operation of the 260, review the SHOCK HAZARD definition printed on page vi of the manual. Also, do not use this Instrument and its accessories on induction heating, X-ray machines, or power sub-stations where high voltage and low impedance equipment is used.

4.1 GENERAL

4.1.1 This section of the manual contains information required to use and operate the 260 in a safe and proper manner.

4.2 SAFETY PRECAUTIONS

4.2.1 The 260 should only be used by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury.

4.2.2. Do not work alone when making measurements of circuits where a shock hazard might exist. Notify a nearby person that you are making, or intend to make such measurements.

4.2.3 Locate all voltage sources and accessible current paths before making measurement connections. Be sure the equipment is properly grounded and the right rating and type of fuse(s) is installed. Set the Instrument to the proper range before applying power.

CAUTION

Continuity of all parts required to be connected to the protective grounding means shall be verified by either visual inspection or electrical test.

REMEMBER: Voltages may appear unexpectedly in defective equipment. An open bleeder resistor may result in a capacitor retaining a dangerous charge. Turn off power and discharge all capacitors before connecting or disconnecting test leads to and from the circuit being measured.

4.2.4 Inspect the test leads for cracks, breaks or crazes in the insulation, prods, and connectors before each use. If any defects are noted, replace the test leads immediately.

4.2.5 Do not make measurements in a circuit where corona is present. Corona can be identified by a pale blue color emanating from sharp metal points in the circuit, or by a buzzing sound, or by the odor of ozone. In rare instances, such as around germicidal lamps, ozone might be generated as a normal function. Ordinarily, the presence of ozone indicates the presence of high voltage and probably an electrical malfunction.

4.2.6 Hands, shoes, floor, and workbench must be dry. Avoid making measurements under humid, damp, or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or Instrument.

4.2.7 For maximum safety, do not touch test leads or Instrument while power is applied to the circuit under test.

4.2.8 Use extreme caution when making measurements where a dangerous combination of voltages could be present, such as in an r-f amplifier.

4.2.9 Do not make measurements using test leads of lesser safety than those originally furnished with the Instrument.

4.2.10 Do not touch any object which could provide a current path to the common side of the circuit under test or power line

ground. Always stand on a dry insulating surface capable of withstanding the voltage being measured, or that could be encountered.

4.2.11 The range or function switch should only be changed when the power to the circuit under measurement is turned off. This will provide maximum safety to the user, eliminate arcing at the switch contacts, and prolong the life of the Instrument.

NOTE: Do not exceed the maximum rated circuit-to-ground voltage of the Instrument (Table 1-1, item 16).

4.2.12 POLARITY CORRECTION

4.2.13 When making DC measurements with the test leads connected to the + and COMMON jacks, polarity can be reversed with the function switch without reversing the test leads. When making measurements on the 50 μA/250 mV range, or 5A range, polarity can be corrected only by reversing the test leads.

NOTE: Change the range switch or function switch positions only when the power to the circuit being measured is turned off or when the test leads are disconnected. In addition to safety, this practice will eliminate arcing at the switch contacts and prolong the life of the Instrument.

4.3 DC VOLTAGE MEASUREMENT 0-250 mV RANGE

WARNING

Prior to making voltage measurements, review the SAFETY PRECAUTIONS listed in paragraph 4.2. Also, when using the 260 as a millivoltmeter, care must be taken to prevent damage to the indicating instrument from excessive voltage. Before using the 250 millivolt range, use the 1.0-volt DC range to determine that the voltage measured is not greater than 250 millivolts (or 2.5 volt DC).

a. Set the function switch at +DC (Figure 4-1).

b. Plug the black test lead in the — COMMON jack and the red test lead into the +50 μAMPS/250mV jack.

c. Set the range switch at 50 μAMPS (COMMON)position with 50V .

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Read the voltage on the black scale marked DC and use the figures marked 0-250. Read directly in millivolts.

4.4 DC VOLTAGE MEASUREMENT 0-I V RANGE

a. Set the function switch at +DC (Figure 4-1).

b. Plug the black test lead into the -COMMON jack and the red test lead into the +1V jack.

c. Set the range switch at 1V (COMMON position with 2.5V).

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Read the voltage on the black scale marked DC and use the figures marked 0-10. Then divide the reading by 10.

4.5 DC VOLTAGE MEASUREMENT 0-2.5 THROUGH 0-500V RANGE

a. Set the function switch at +DC (Figure 4-1).

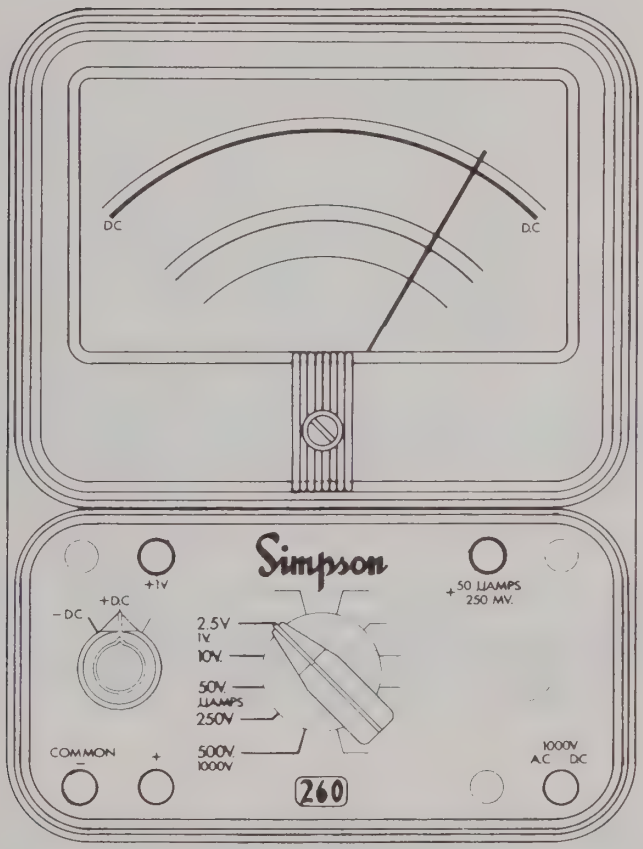

Figure 4-1. Jacks and Switch Positions for Measuring DC Voltage

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Set the range switch at one of the five voltage range positions marked 2.5V, 10V, 50V, 250V or 500V.

NOTE: When in doubt as to the voltage present, always use the highest voltage range as a protection to the Instrument. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading. Be sure power is off in the circuit being measured and all capacitors discharged.

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Turn on the power in the circuit being measured.

f. Read the voltage on the black scale marked DC. For the 2.5V range, use the 0-250 figures and divide by 100. For the 10V, 50V, and 250V ranges, read the figures directly. For the 500V range, use the 0-50 figures and multiply by 10.

NOTE: Turn off power to the circuit and wait until the meter indicates zero before disconnecting the test leads.

4.6 DC VOLTAGE MEASUREMENT 0-1000V RANGE

WARNING

Be extremely careful when working with high voltage circuits. Do not touch the Instrument or test leads while power is on in the circuit being measured.

4.6.1 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at +DC (Figure 4-1).

b. Set the range switch at 1000V (dual position with 500V).

c. Plug the black test lead into the -COMMON jack and the red test lead into the 1000V jack.

d. Be sure power is off in the circuit being measured and all capacitors discharged. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Turn on power in circuit being measured.

f. Read the voltage using the 0-10 figures on the black scale marked DC. Multiply the reading by 100.

REMEMBER: Turn off power to the circuit and wait until the meter indicates zero before disconnecting the test leads.

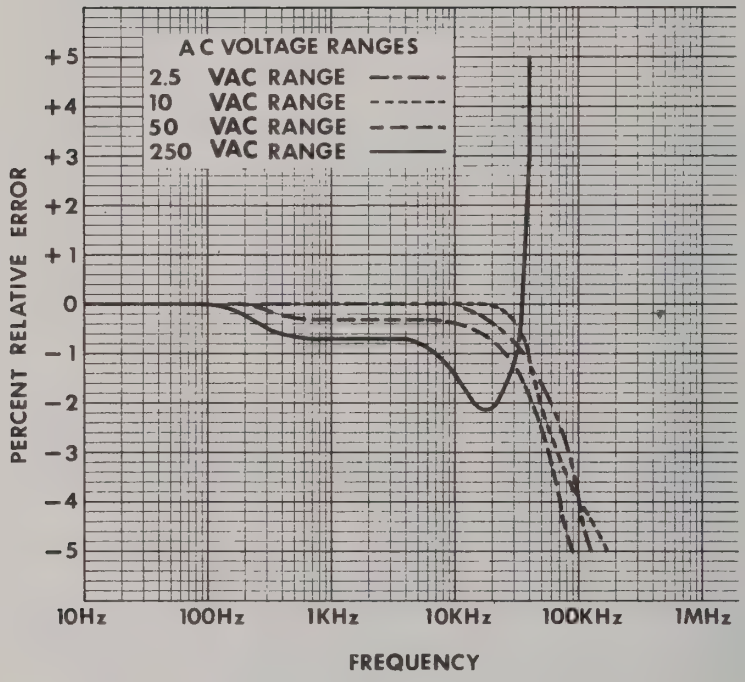

Figure 4-2. Frequency Response, AC Voltage Ranges

4.7 AC VOLTAGE MEASUREMENT 0-2.5 THROUGH 0-500V RANGE

CAUTION

When measuring line voltage, such as from a 120 volt, 240 volt or 480 volt source, be sure that the range switch is set to the proper voltage position.

4.7.1 The 260 responds to the average value of an AC waveform. It is calibrated in terms of the rms value of a pure sine wave. If the waveform is nonsinusoidal, and depending upon its waveform, the reading may be either higher or lower than the true rms value of the measured voltage. Thus an error may be introduced if the 260 is used to measure a nonsinusoidal waveform. Also, accuracy is lessened at higher input frequencies (Figure 4-2).

4.7.2 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-3).

b. Set the range switch at one of the five voltage range positions marked 2.5V, 10V, 50V, 250V or 500V. (When in doubt as to actual voltage present, always use the highest voltage range as a protection to the Instrument. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.)

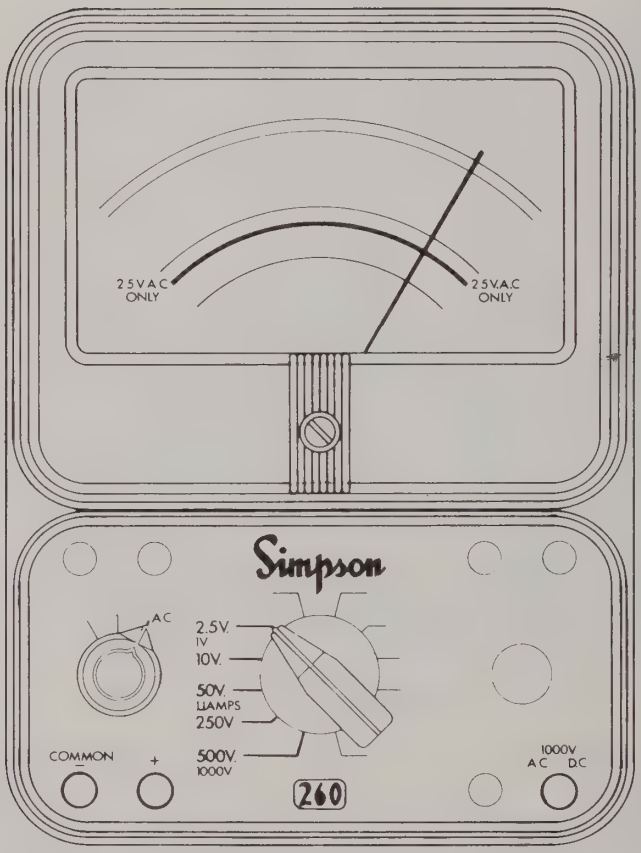

Figure 4-3. Jacks and Switch Positions for Measuring AC Voltage

c. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

d. Connect the test leads across the voltage source.

e. Turn on power in the circuit being measured.

f. For the 0-2.5V range read the value directly on the scale marked 2.5 VAC. For the 10V, 50V, and 250V ranges, read the red scale marked AC and use the black figure immediately above the scale. For the 500V range, read the red scale marked AC and use the 0-50 figures. Multiply the reading by 10.

4.8 AC VOLTAGE MEASUREMENT 0-1000V RANGE

WARNING

Be extremely careful when working in high voltage circuits. Do not touch the Instrument or test leads while the power is on in the circuit being measured.

4.8.1 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-3).

b. Set the range switch at 1000V (dual position with 500V).

c. Plug the black test lead in the COMMON jack and the red test lead in the 1000V jack.

d. Be sure the power is off in the circuit being measured and that all capacitors have been discharged. Connect the test leads to the circuit.

e. Turn on the power in the circuit being measured.

f. Read the voltage on the red scale marked AC. Use the 0-10 figures and multiply by 100.

4.9 OUTPUT VOLTAGE MEASUREMENT

4.9.1 It is necessary to measure the AC component of an output voltage where both AC and DC voltage levels exist. This occurs primarily in amplifier circuits. The 260 has a 0.1 μF, 400 volt capacitor in series with the OUTPUT jack. The capacitor blocks the DC component of the current in the test circuit, but allows the AC or desired component to pass on to the indicating instrument circuit. The blocking capacitor may alter the AC response at low frequencies but is usually ignored at audio frequencies (Figure 4-4).

CAUTION

When using OUTPUT, do not apply to a circuit where the DC voltage component exceeds 350 volts.

4.9.2 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-5).

b. Plug the black test lead into the -COMMON jack and the red test lead into the OUTPUT jack.

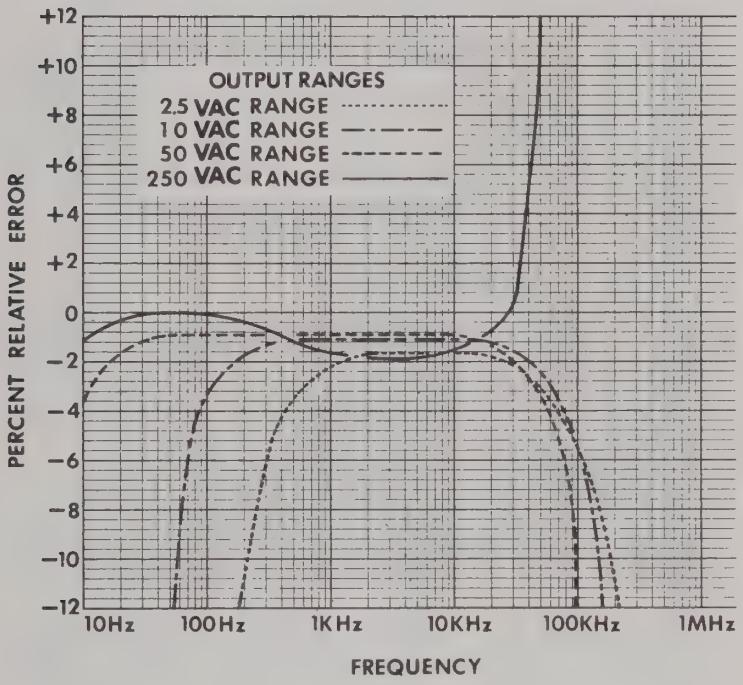

Figure 4-4. Frequency Response Output Ranges

c. Set the range switch at one of the range positions marked 2.5V, 10V, 50V, or 250V.

d. Connect the test leads across the circuit being measured with the black test lead to the ground side.

e. Turn on the power in the test circuit. Read the output voltage on the appropriate AC voltage scale. For the 0-2.5V range, read the value directly on the scale marked 2.5 VAC. For the 10V, 50V, or 250V ranges, use the red scale marked AC and read the black figures immediately above the scale.

4.10 DECIBEL MEASUREMENT

a. For some applications, output voltage and audio frequency voltage are frequently measured in terms of decibels. The decibel scale (dB) at the bottom of the dial is marked from —20 to +10 (Figure 4-6).

b. To measure decibels, read the dB scale in accordance with instructions for measuring AC. For example, when the range switch is set on the 2.5V position, the dB scale is read directly.

c. The dB readings on the scale are referenced to zero dB power level of .001 watt in 600 ohms, or 0.775 VAC across 600 ohms.

d. For the 10V range, read the dB scale and add +12 dB to the reading. For the 50V range, read the dB scale and add +26 dB to the reading. For the 250V range, read the dB scale and add +40 db to the reading.

e. If the zero dB level is .006 watt in 500 ohms, subtract 7 dB from the reading.

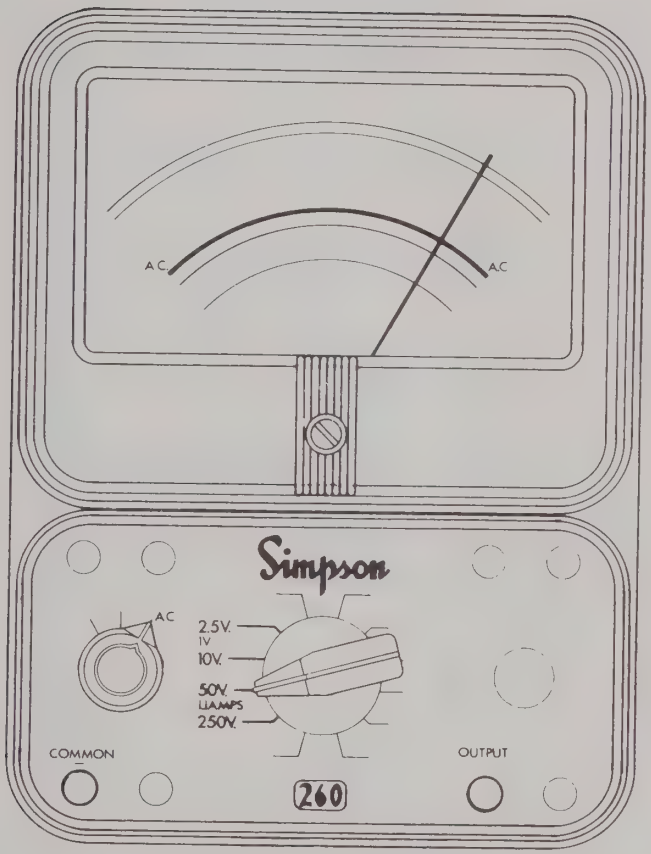

Figure 4-5. Jacks and Switch Positions for Output Measurement

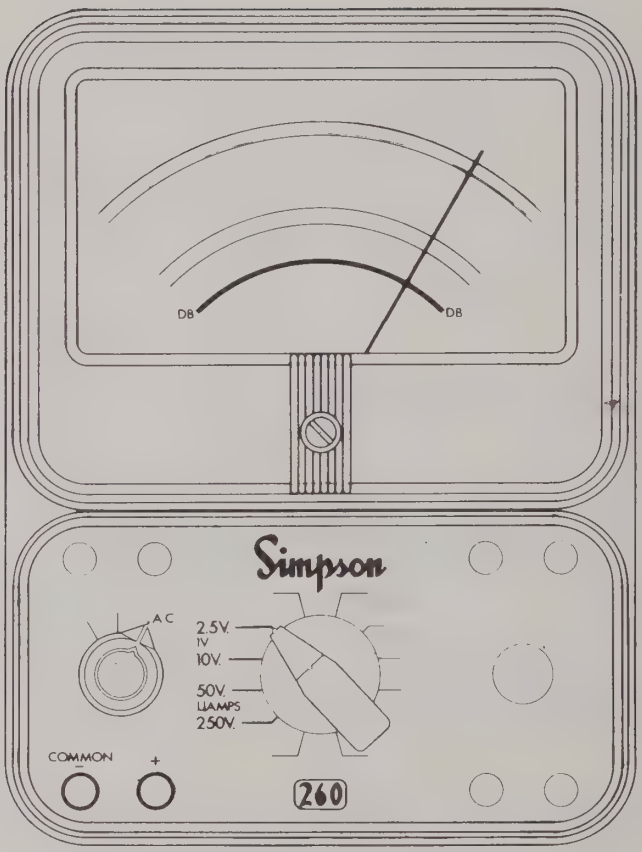

Figure 4-6. Jacks and Switch Positions for Measuring Decibels

4.11 DIRECT CURRENT MEASUREMENT

WARNING

- Do not change the range setting of the Range or Function Switches while the circuit under measurement is energized.
- Never disconnect the test leads from the circuit under measurement while the circuit is energized.
- Always turn the power off and discharge all the capacitors before the setting of the switches is changed, or the leads disconnected.
- Never exceed the Circuit-To-Ground voltage of the instrument (1000 V max; Table 1-1, item 16).
- Always connect the Instrument in series with the ground side of the circuit.
- In all direct current measurements, make certain the power to the circuit being tested has been turned off before connecting and disconnecting test leads or restoring circuit continuity.

4.12 DIRECT CURRENT MEASUREMENT 0-50μA RANGE

a. Set the function switch at +DC.

b. Plug the black test lead into the —COMMON jack and the red test lead into the +50μAMPS/250mV jack.

c. Set the range switch at 50μAMPS (dual position with 50V).

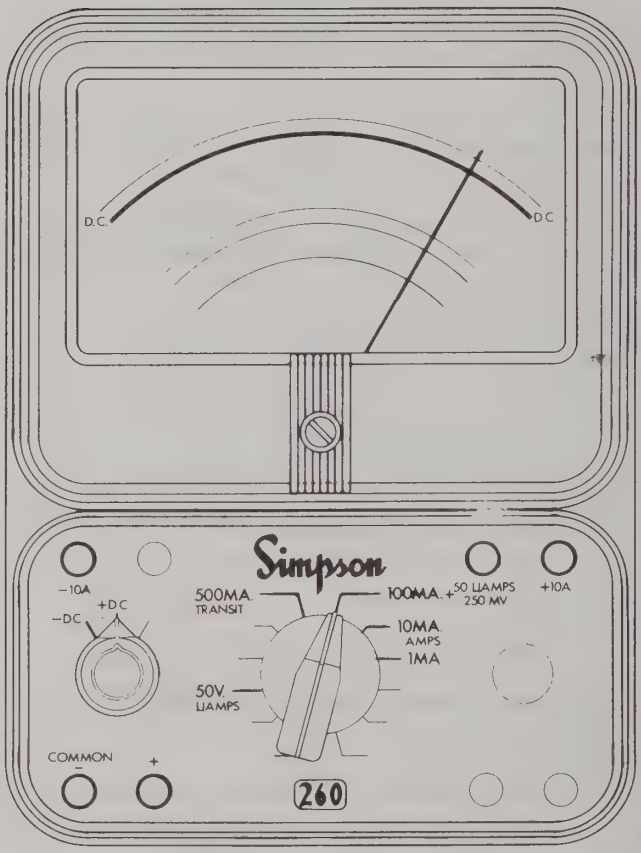

Figure 4-7. Jacks and Switch Positions for Measuring Direct Current

d. Open the ground side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

e. Read the current on the black DC scale. Use the 0-50 figures to read directly in microamperes.

4.13 DIRECT CURRENT MEASUREMENT 0-1mA THROUGH 0-500mA RANGE

a. Set the function switch at +DC (Figure 4-7).

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Set the range switch at one of the four range positions marked 1 mA, 10 mA, 100 mA or 500 mA.

d. Open the grounded side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

e. Turn the power on. Read the current in milliamperes on the black DC scale. For the 1mA range, use the 0-10 figures and divide by 10. For the 10mA range, use the 0-10 figures directly. For the 100mA range, use the 0-10 figures and multiply by 10. For the 500mA range, use the 0-50 figures and multiply by 10.

f. Turn the power off and disconnect the test leads.

4.14 DIRECT CURRENT MEASUREMENT 0-10A RANGE

a. Plug the black test lead into the -10A jack and the red test lead into the +10A jack.

b. Set the range switch at 10 AMPS (dual position with 10mA).

c. Open the ground side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

NOTE: The function switch has no effect on polarity for the 10 AMPS range.

d. Turn the power on. Read the current directly on the black DC scale. Use the 0-10 figures to read directly in amperes.

e. Turn the power off and disconnect the test leads.

CAUTION

When using the 10 ampere range, never remove a test lead from its panel jack while the current is flowing through the circuit. Otherwise, injury to the user and damage to the instrument may occur.

4.15 TRANSIT POSITION

4.15.1 The 500 mA range switch position is also the TRANSIT position. The additional damping of the movement in the TRANSIT position will reduce pointer swing when the 260 is carried.

4.16 RESISTANCE MEASUREMENTS

4.16.1 When resistance is measured, VOM batteries B1 and B2 furnish power for the circuit. Since batteries are subject to variation in voltage and internal resistance, the Instrument must be adjusted to zero before measuring a resistance, as follows:

a. Turn range switch to desired ohms range.

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Connect ends of test leads together to short the VOM resistance circuit.

d. Rotate the ZERO OHMS control until pointer indicates zero ohms. If pointer cannot be adjusted to zero, one or both of the batteries must be replaced. (For battery replacement, refer to Section V.)

e. Disconnect shorted ends of test leads.

4.17 MEASURING RESISTANCE

a. Before measuring resistance in the circuit make sure the power is off to the circuit being tested and all capacitors are dis-

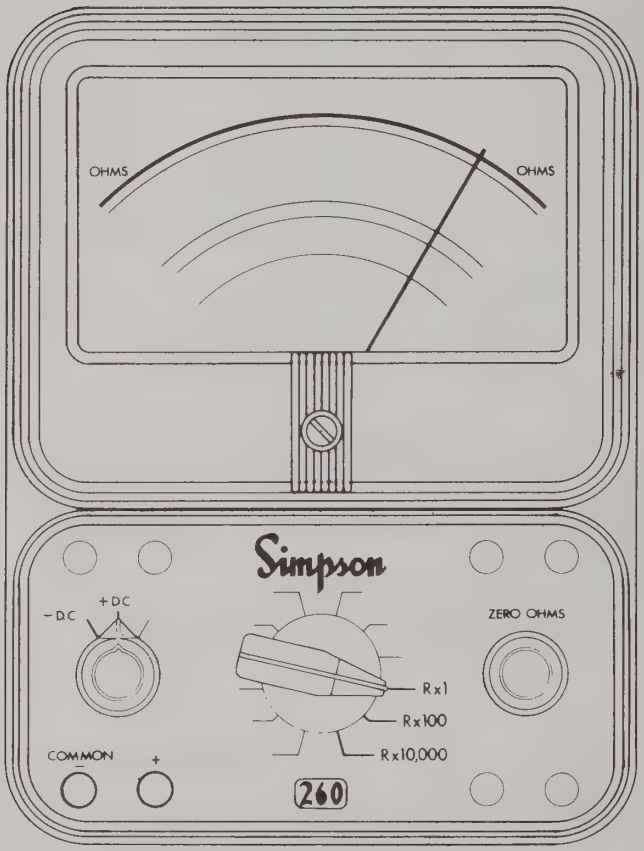

Figure 4-8. Jacks and Switch Positions for Measuring Resistance

charged. Disconnect shunted component from the circuit before measuring its resistance.

b. Set the range switch to one of the resistance range positions as follows (Figure 4-8):

1. Use R $\times$ 1 for resistance readings from 0 to 200 ohms.

2. Use R $\times$ 100 for resistance readings from 200 to 20,000 ohms.

3. Use R $\times$ 10,000 for resistance readings above 20,000 ohms.

c. Set the function switch at either -DC or +DC position:

Operation is the same in either position except if there are semiconductors in the circuit. (See Paragraph 4.2.1) Adjust ZERO OHMS control for each resistance range.

d. Observe the reading on the OHMS scale at the top of the dial. *Note: the OHMS scale reads from right to left for increasing values of resistance.*

e. To determine the actual resistance value, multiply the reading by the factor at the switch position. (K on the OHMS scale equals one thousand.)

4.18 RESISTANCE MEASUREMENT OF SEMICONDUCTORS

CAUTION

Make sure that the OHMS range being used will not damage any of the semiconductors (refer to Table 1-1, item 8, Section I).

4.18.1 If there is a "forward" and "backward" resistance such as in diodes, the resistance should be relatively low in one direction (for forward polarity) and higher in the opposite direction. Rotate the function switch between the two DC positions to reverse polarity. This will determine if there is a difference between the resistance in the two directions. To check a semiconductor in or out of a circuit (forward and reverse bias resistance measurements), consider the following *before* making the measurement:

a. The polarity of the internal ohmmeter battery voltage at the (+) pos jack is identical to the function switch, polarity setting, and opposite to the (—) common jack.

b. Ensure that the range selected will not damage the semiconductor. (Refer to Table 1-1 in Section I, and review the specification limits of the semiconductor according to the manufacturer's ratings.)

c. If the semiconductor is a silicon diode or conventional silicon transistor, no precautions are normally required.

d. If the semiconductor material is germanium, check the ratings of the device and refer to Table 1-1, item 8, Section I.

NOTE: The resistance of diodes will measure differently from one resistance range to another on the same VOM with the function switch in a given position. For example, a diode which measures 80 ohms on the R $\times$ 1 range may measure 300 ohms on the R $\times$ 100 range. The difference in values is a result of the diode characteristics and is not indicative of any fault in the VOM.

SECTION V

OPERATOR SERVICING

5.1 GENERAL

5.1.1 The following paragraphs of this section describe the battery replacement, fuse replacement, removing the instrument case, and test lead inspection and procedures for the Simpson 260.

5.2 BATTERY REPLACEMENT

a. Two batteries are used inside the case to supply power for resistance measurements. One is a 1.5-volt D cell and the other is a 9-volt battery. When it is no longer possible to adjust the pointer to zero for the R $\times$ 1 and R $\times$ 100 ranges (refer to ZERO OHMS ADJUSTMENT paragraph 4.16) replace the 1.5-volt cell. When it is no longer possible to adjust the pointer to zero on the R $\times$ 10,000 range, replace the 9-volt battery.

b. Recommended replacement batteries are:
1.5-volt D cell, NEDA 13F (Burgess No. 2; Eveready No. 950).
9-volt battery, NEDA 1604 (Burgess 2U6 or Eveready 216).

c. To install or replace a battery, de-energize and disconnect test leads from the Instrument, then remove the cover to the externally accessible battery compartment by loosening the single captivated screw.

NOTE: Batteries should be replaced before their useful life has expired. Failure to do so may result in corrosion and battery leakage.

d. Observe polarity when replacing the 1.5-volt D cell and connect as indicated. The D cell is held in place with spring clips which also act as battery contact clips. The 9-volt battery contacts and connector are polarized. To remove the 9-volt battery, first withdraw battery with mated connector from the compartment. Then remove the connector.

5.3 FUSE REPLACEMENT

5.3.1 One-Ampere Fuse:

5.3.2 The 1-ampere fuse (also the spare) is located in the externally accessible battery and fuse compartment. Access to the compartment is obtained by de-energizing and disconnecting the test leads and loosening the single captivated screw on the compartment cover. To replace a burned out fuse,remove the 9-volt battery, then replace the fuse.

5.3.3 Two-Ampere Fuse:

5.3.4 The 2-ampere fuse is located within the instrument panel under the printed circuit board. (To gain access to the fuse, see paragraph 5.4.)

NOTE: It is important to replace the 1 and 2 ampere fuse with the specified fuse type only. (See paragraph 1.2.9 and replacement parts list, Table 6-1, for proper fuse type.)

5.4 REMOVING THE INSTRUMENT CASE

5.4.1 To gain access to the inside of the Instrument panel, for replacing the fuse, first: de-energize and disconnect the test leads, and remove the cover from the battery compartment, then remove the four case-fastening screws. Second: after removing the screws, lift the case from the panel.

NOTE: When replacing the case, make certain that the wires leading to the battery compartment are seated in their respective slots within the compartment wall. This will prevent damage to the wire insulation during mating of panel and case.

5.5 TEST LEAD INSPECTION

5.5.1 Periodic inspection of the test leads is recommended to detect cuts, burned areas, deterioration or other damage that could reduce the insulation strength of the leads.

NOTE: Before returning the Instrument to service, check the performance ratings and make sure that the electrical and mechanical configurations have been restored to their original applications.

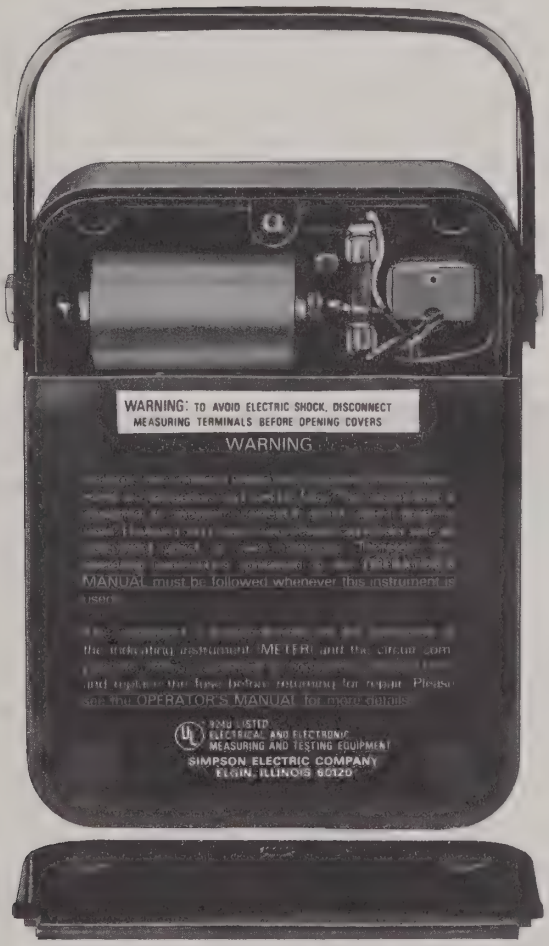
WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT MEASURING TERMINALS BEFORE OPENING COVERS
WARNING
MANUAL must be followed whenever this instrument is
the indicating instrument, METER, and the circuit com
and replace the fuse before returning for repair. Please
see the OPERATOR'S MANUAL for more details.
LISTED
ELECTRICAL AND ELECTRONIC
MEASURING AND TESTING EQUIPMENT
SIMPSON ELECTRIC COMPANY
ELGIN, ILLINOIS 60120

Figure 5-1. Battery and Fuse Compartment.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

SECTION VI

SERVICING INSTRUCTIONS

6.1 GENERAL

NOTE

This instrument must be serviced by qualified personnel. To aid in troubleshooting a schematic diagram is enclosed. The replacement parts list (Table 6-1) describes the components and refers to Simpson part numbers. Reference Symbol numbers correlate the components shown on the schematic diagram with the parts list.

6.1.1 The following information is provided as an adjunct to the overall text contained in this manual and should be read and understood thoroughly prior to ordering replacement parts for the Instrument.

6.2 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

6.2.1 To obtain replacement parts, address order to the nearest Authorized Service Center (listed on the last pages of this manual). Refer to paragraph 2.3.1 for ordering instructions.

Table 6-1. Replacement Parts

Reference Symbol	Description	Part No.
R1	Rheostat, 200 kΩ	1-110193
R2	Rheostat, 5 kΩ	5-114099

R3	Resistor, 15 kΩ	5-110756
R4	Resistor, 45 kΩ	1-114192
R5	Resistor, 150 kΩ	1-113366
R6	Resistor, 800 kΩ	1-113363
R7	Resistor, 4 MΩ	1-113362
R8	Resistor, 5 MΩ	5-110454
R9	Resistor, 7.5 MΩ	5-111668
R10	Resistor, 2.5 MΩ	5-111669
R11	Resistor, 0.025Ω Shunt, 10A (Calibrate in VOM)	3-811793
R12	Resistor, 0.468Ω (Bobbin)	10-675254
R13	Resistor, 2Ω (Bobbin)	10-805077
R14	Resistor, 22.5Ω (Bobbin)	10-805076
R15	Resistor, 238Ω	1-115897
R16	Resistor, 11Ω, 5W (Wire Wound)	5-119567
R17	Resistor, 1.109 kΩ	5-112938
R18	Resistor, 123.5Ω	5-112939
R19	Resistor, 17.55 kΩ	5-113020
R20	Resistor, 113.7 kΩ	5-112941
R21	Potentiometer, 11.25 kΩ	5-115263
R22	Rheostat, 5 kΩ	1-116254
R23	Resistor, 4 kΩ	5-114835
R24	Resistor, 4 kΩ	5-114835
R25	Rheostat, 5 kΩ	1-116254
R26	Resistor, 7.5 kΩ	1-113370
R27	Resistor, 37.5 kΩ	1-113393
R28	Resistor, 200 kΩ	1-113365
R29	Resistor, 1 MΩ	1-113392

R30	Resistor, 1.25 MΩ	5-115068
C1	Capacitor, 0.1 μF, 400V	1-113733
D1	Diode, Germanium	1-115970
D2	Diode, Germanium	1-115970
V1	Varistor, Silicon	1-110670
F1	Fuse, 1 Amp, 250V; 3AG (1¼" x ¼") Quick acting (Littelfuse Type 312001)	1-112507
F2	Fuse, 2 Amp, 600V (Bussman Type BBS or KTK)	5-119056
	Knobs: For Function Switch	1-115789
	Knobs: For Zero Ohms Adjust	1-115790
F1	Knobs: For Range Switch (less Set Screw)	3-260180
	Knobs: Set Screw (for Knob 3-260180)	1-114178
	Case Assembly, Phenolic, Complete, (including handle less Battery Compartment Cover)	10-861725
	Battery Compartment Cover Assembly	10-861724
	Rubber Bumper Plug	5-115039
	260-6, 260-6RT Indicating Instrument with Panel Assembly	D13721
	260-6M, 260-6MRT Indicating Instrument with Panel Assembly	D13722
	Cover Assembly for Indicating Instrument	0-005674
	Probe Tip Leads, one red and one black	00125
	Label, UL Listing	6-110977
	Label, Operator Servicing	6-110960
	Label, Battery and Fuse Data	6-110959
	Label, Terminal Rating	6-110979
	Label, Warning	6-111474

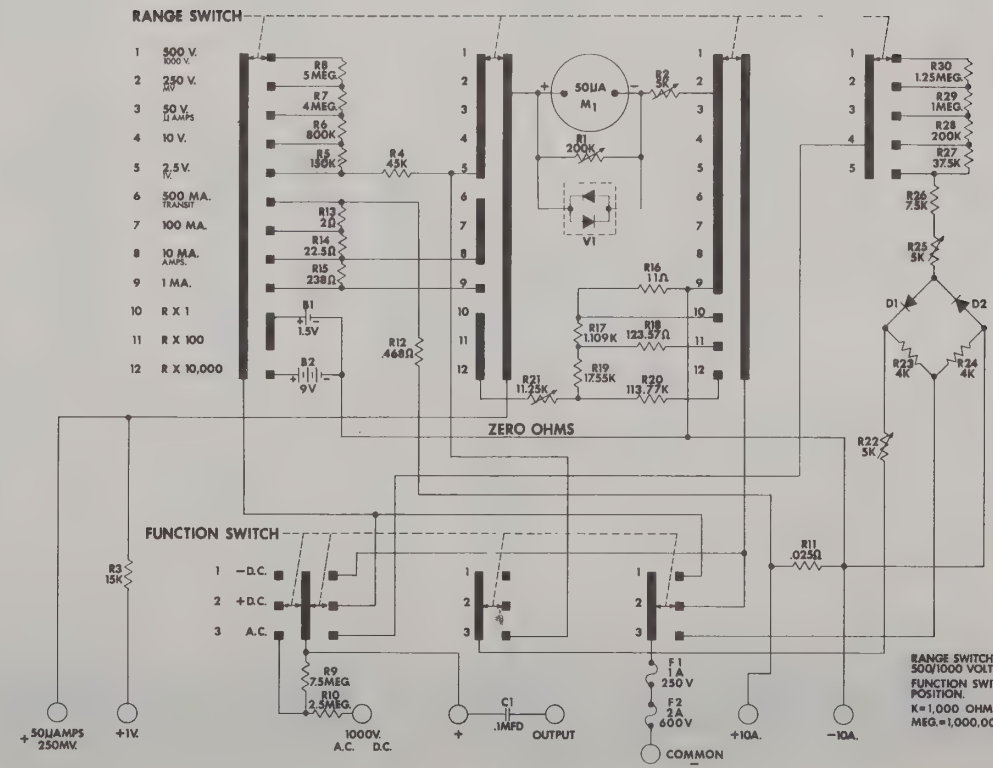

Figure 6-1. Schematic Diagram

AUTHORIZED SERVICE CENTERS

SIMPSON ELECTRIC COMPANY

853 Dundee Avenue, Elgin, Illinois 60120 — Phone: (312) 697-2260

★ Parts Sales & Repair Service Only

★★ Parts, General Test Equipment & Panel Instrument Sales & Service

★★★ Same Service As (★★) Above Plus Panel Instrument Modification

★★★☐ Additionally Authorized for Service on Recorders, Controllers, Digital Products and Lab Portables

★★★ALABAMA, MOBILE 36617
☐ BROWNELL-ELECTRO INC.
3450 Armour Drive
Tel. 205/479-8581

★ALASKA, ANCHORAGE 99501
YUKON RADIO SUPPLY, INC.
3222 Commercial Drive
P.O. Box 406
Tel. 907/277-1497

★ALASKA, ANCHORAGE 99500
R. M. ZOOK & ASSOCIATES
1710 E. 27th Avenue
Tel. 907/272-6917

★ALASKA, FAIRBANKS 99701
YUKON RADIO SUPPLY, INC.
1112 Cushman Street
Tel. 907/452-1011

★★★ARIZONA, PHOENIX 85040
☐ METERMASTER INC.
4134 E. Wood Street
Tel. 602/243-4111

★★CALIFORNIA, LOS ANGELES 90040
☐ E.I.L. INSTRUMENTS INC.
6212 Peachtree St.
Tel. 213/685-7020

★★★CALIFORNIA, GLENDALE 91201
☐ WEATHERFORD INSTRUMENT DIV.
WESTERN ELECTRONIC SUPPLY CORP.
640 Allen Street
Tel. 213/246-4861

★★★CALIFORNIA, LOS ANGELES 90040
☐ METERMASTER, INC.
5646 Jillson Street
Tel. 213/685-4340

★★★CALIFORNIA, PALO ALTO 94303
☐ METERMASTER, INC.
3995 E. Bayshore Road
Tel. 415/968-0313

★★★CALIFORNIA, SAN DIEGO 92123
☐ METERMASTER/SAN DIEGO
8799 Balboa Avenue
Tel. 714/560-4841

★★★CALIFORNIA, SAN FRANCISCO 94105
PACIFIC ELECTRICAL
INSTRUMENT LAB
150 Folsom
Tel. 415/543-3104

★★★CALIFORNIA, SANTA CLARA 95050
☐ FISHER-BROWNELL
3381 Edward Avenue
Tel. 408/988-6041

★★★CALIFORNIA, SOUTH PASADENA 91030
☐ ETALON COMPANY
1323 Huntington Drive
Tel. 213/257-5410

★★★COLORADO, DENVER 80223
☐ METER MASTER INSTRUMENT
CORPORATION
1165 S. Cherokee
Tel. 303/722-5766

★★★CONNECTICUT, MIDDLETOWN 06457
☐ THE MANCIB COMPANY
Subsidiary of E.I.L. Instruments
Randolph Road and Coe
Tel. 203/346-6646

★★FLORIDA, MIAMI 33136
FLORIDA PRECISION INSTRUMENT
COMPANY
800 N.W. 7th Avenue
Tel. 305/324-1731

★★★FLORIDA, MIAMI 33142
☐ KIMBALL ELECTRONIC LAB., INC.
3620 N.W. 48 Terrace
Tel. 305/635-9712

★★★FLORIDA, ORLANDO 32806
☐ BROWNELL-ELECTRO INC.
307 27th St., Box 8945
Tel. 305/843-6775

★★FLORIDA, TAMPA 33614
TAMPA INSTRUMENTATION CENTER
A.C. FERNANDEZ ELECTRIC
4807 N. Church Avenue
Tel. 813/870-0183

★★★GEORGIA, ATLANTA 30354
☐ BROWNELL-ELECTRO INC.
3020 Commerce Way
Tel. 404/762-5181

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EMC CORPORATION
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★★★**NEW JERSEY, SOUTH**
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BROWNELL-ELECTRO INC.
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3500 Bleachery Place
Tel. 315/737-7328

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85 Tenth Avenue
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★★★**NEW YORK, NEW YORK 10011**
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LABORATORY, INC.
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Tel. 212/675-7944

★★★**NEW YORK, ROCHESTER**
☐ ELECTRONIC INSTRUMENT COMPANY
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Tel. 716/328-4350

★★★**NORTH CAROLINA, CHARLOTTE 28216**
☐ BROWNELL-ELECTRO INC.
5141 Belhaven Blvd.
Box #16368
Tel. 704/394-4341

★★★**NORTH CAROLINA, RALEIGH 27612**
☐ INSTRUMENT TECHNICAL REP.
Rt. 8 — Box 115-C1
Umstead Industrial Park
Tel. 919/781-5256

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4800 East 131st Street
Tel. 216/587-3600

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Tel. 216/238-2550

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HUSTON LABORATORIES, INC.
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Tel. 405/235-5469

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Tel. 713/526-6871 & 72

★★★**TEXAS, HOUSTON 77023**
☐ METERS & INSTRUMENTS CORP.
6428 Gulf Freeway
Tel. 713/644-1631

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2127 Kermit Highway
P.O. Box 2373
Tel. 915/332-0565

★★★**TEXAS, ODESSA 79760**
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1306 North Texas
Tel. 915/337-3412

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5400 Cherokee Avenue
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1835 Lockhard Street
Tel. 804/424-5121

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★★★**VIRGINIA, CHESTERFIELD 23831††**
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Tel. 804/275-1431

★★★**WASHINGTON, SEATTLE 98105**
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NOTES

Quality is the indispensable component of every Simpson instrument . . . . . .

Hugo Chalaghe
Apt
Feb 53

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

MODEL 305
and MODEL 305-RC
TUBE TESTER

SIMPSON ELECTRIC CO.
5200-5218 Kinzie St., Chicago 44, Ill.

Foreword

There are several types of tube-testers for the serviceman. Simpson manufactures all different accepted types. Among these, the Simpson Models 305 and 305RC are the most modest in price. But this does not mean that they are limited in performance of necessary functions. Such instruments are simply not produced by Simpson, because Simpson does not manufacture to sell at a price. First consideration is the design of an instrument that will do a thorough job.

Simpson Models 305 and 305RC are designed to provide accurate testing for all tubes with filament voltages from .5 volts to and including 120 volts. It tests loctals, single ended tubes, bantams, midgets, miniatures, ballast tubes, gaseous rectifiers, acorn tubes, Christmas tree bulbs, and all popular radio receiver tubes.

Like other Simpson tube-testers, the 305's incorporate 3-way switching which makes it possible to test any tube regardless of its base connections or the internal connections of its elements. This method, the result of exhaustive research and expensive construction, protects the Model 305's against obsolesence. No adapters or special sockets are required. In addition to having a complete set of sockets for every tube now on the market, this tester has a spare socket, to provide for future tube developments.

On the Model 305RC, the "No-Backlash" Roll Chart prevents the chart from being torn or from getting out of align-

ment by automatically keeping chart in constant tension. This gives precision selection at all times. If you will remove the Roll Chart unit you will see the very superior Simpson construction throughout. It is, beyond question, the finest roll chart mechanism, in design and in quality manufacture, on any tube tester today.

These testers have provision for testing pilot lamps of various voltages as well as Christmas tree bulbs. It tests gaseous rectifiers of the OZ4 type—also tests ballast tubes direct in socket for burnouts and opens. Has neon bulb of proper sensitivity for checking shorts. This tube-tester is fused, and has the latest improved circuit. It provides for line adjustment from 100 to 130 volts, with smooth vernier control.

When you purchase Simpson test equipment you get equipment made almost entirely within the various plants of our Company. We are by far more self-contained than any other manufacturer of test equipment. This is your assurance that testers we offer will not quickly become obsolete. Our tremendous investment in expensive production tools is your safeguard against obsolescence and further assurance of unvarying quality.

Here at Simpson we do not regard our job finished when we have sold an instrument. Our interest in your Model 305 or 305RC never ceases. We want your satisfaction with it to be continuing. That is the reason for this Operator's Manual. We want you to know how to get the most from your tube-tester.

We have made this instrument as rugged as we know how. Give it the care and careful handling it deserves, and it will give you a lifetime of accurate, dependable service.

Simpson Model 305 Tube Tester

Size: 8" x 10¾" x 5½". Weight: 8 lbs.

OPERATOR'S MANUAL

SIMPSON MODEL 305 AND MODEL 305-RC TUBE TESTER

GENERAL

The toggle switches marked C, 1, 2, 3, 4, 5, 6, 7, and 8 are connected to the correspondingly numbered tube elements in accordance with the standard RMA numbering system. Toggle switch 9 is a meter reversing switch.

The position of any of the rotary or toggle switches for the various tests on a tube are indicated on the chart. Any of the toggle switches which are not indicated on the chart are to be left in the *normal* position. Normal position for switches C, 1, 2, 3, 4, 5, 6, 7 and 8 is center. **Normal position for switch 9 is down.**

Multipurpose tubes such as the 1B5 or 1E7 require more than one test and the switches should be reset for each of the tests as indicated on the chart.

OPERATING PROCEDURE

1. Set all of the group of ten toggle switches, located just below the meter, to the normal position.

2. Rotate the switches marked FILAMENT SELECTOR, FILAMENT RETURN, and TUBE SELECTOR to the position shown on the chart.

3. Throw any toggle switches to the downward position if so called for on the chart in column TOG DOWN.

4. Insert the tube in the proper socket.

5. Test the line voltage by throwing the LINE TEST—TUBE TEST switch to the LINE TEST position. Adjust the line voltage by rotating the knob marked LINE ADJUSTMENT until the meter pointer is at the center mark on the dial marked LINE. Return the LINE TEST—TUBE TEST switch to the TUBE-TEST position.

6. SHORT TEST—CATHODE-HEATER LEAKAGE: If no switch settings are indicated in the column CATHODE-

HEATER LEAKAGE on the chart, the tube has no cathode and no test is necessary.

To test cathode-heater leakage, rotate the CIRCUIT SELECTOR switch to the H position. The neon tube will glow until the toggle switch called for in the CATHODE-HEATER LEAKAGE column is thrown to the upward position. If the neon does not glow, the heater is open. Throw the toggle switch called for on the chart (which is a heater terminal) to the upward position. The neon tube will be dark unless there is a leakage current flowing between the cathode and heater. The tube should be tapped gently during the test. The neon SENSITIVITY switch should ordinarily be in the LOW position to prevent indication of normal leakage currents, especially in high filament voltage tubes. However, if for some reason, it is desired to detect very slight leakage currents between the cathode and heater, the SENSITIVITY switch may be placed in the HIGH position.

After making the CATHODE-HEATER leakage test, return toggle switch, shown in CATHODE-HEATER column, to the *center* or *normal* position.

7. SHORT TEST — LEAKAGES BETWEEN ELEMENTS OTHER THAN CATHODE AND HEATER: To test for leakages between the remaining elements of cathode type tubes and to test leakage between elements of filament type tubes, rotate the CIRCUIT SELECTOR switch to the S position. Throw one of the toggle switches, shown on the chart under column TOGGLES UP (separately), to the upward position and note if the neon glows or flickers, indicating a short or leakage. Then return it to the center or normal position. Repeat this same procedure for each toggle switch indicated on the chart in this column. The tube should be tapped gently during this test and the neon SENSITIVITY switch should be set in the HIGH position.

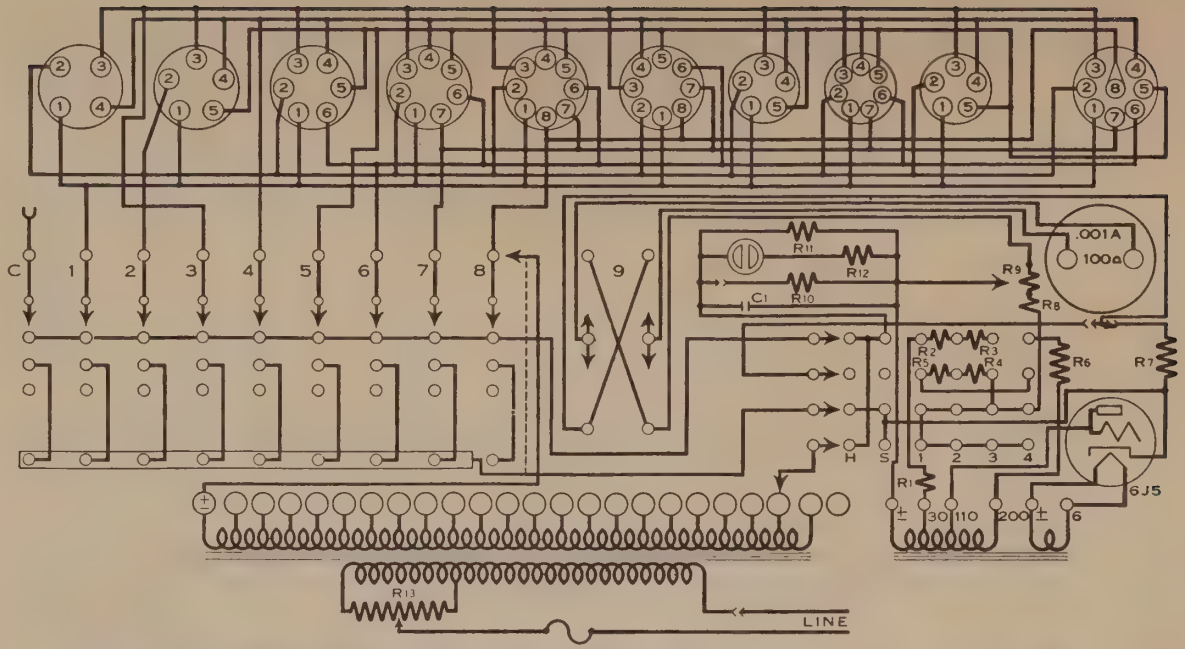
8. QUALITY TEST: After testing the tube for leakages and shorts, rotate the CIRCUIT SELECTOR switch to position 1, 2, 3, or 4 as indicated on the chart. Throw all of the toggle switches called for on the chart to the upward position. Read the condition of the tube on the GOOD-DOUBTFUL-BAD scale on the meter.

9. OPEN ELEMENTS: In the case of a few tubes, certain elements which are comparatively distant from the cathode may be open without much change in the total reading on the dial, so that the pointer will remain in the GOOD portion of the dial. To detect such elements, after making the QUALITY TEST, return each toggle switch to the center or normal position, one at a time. If any of the elements are open, there will be no change in the pointer deflection as the corresponding toggle switch is returned to the center position.

10. PILOT AND CHRISTMAS TREE LIGHTS: The center of the 7-prong socket is arranged for insertion of pilot lamps and Christmas tree bulbs. To test these lamps, rotate the FILAMENT RETURN switch to 1 and the FILAMENT SELECTOR switch to the proper position for the lamp under test, as follows:

Fil. Sel.	Approx. Volts	Fil. Sel.	Approx. Volts
1	0.5	12	17.5
2	0.75	13	25
3	1.0	14	35
4	1.5	15	40
5	2.0	16	50
6	2.5	17	60
7	3.0	18	70
8	5.0	19	80
9	6.0	20	90
10	7.5	21	100
11	12.0	22	110

12. BALLAST TUBES: To test ballast tubes, set the CIRCUIT SELECTOR switch to the S position. Throw all of the ten toggle switches to the downward position. Refer to the tube base wiring diagram of the ballast tube and note the numbers of the two pins to which the resistance element is connected, in accordance with the RMA numbering system. Then test each resistance element separately by throwing the two toggle switches corresponding to the numbers of the two pins, one toggle switch to the center and one to the upward position. The neon tube will glow if the resistance element is not burned out. Return the two toggle switches to the downward position, and repeat the same test on any other resistance element in the ballast tube.



R1	200Ω	R5	200Ω	R9	50Ω	R13	350Ω
R2	800Ω	R6	2,000Ω	R10	1MΩ	C1	00025MFD
R3	4,000Ω	R7	115,000Ω	R11	15MΩ		
R4	70Ω	R8	5Ω	R12	200,000Ω		

MODEL 305
SCHEMATIC
WIRING DIAGRAM

ROLL CHART INSTRUCTIONS (MODEL 305-RC)

To remove old chart:

1. Wind entire chart to the upper roller.

2. Place the mechanism on its side with the panel toward you and the knob to the right.

3. Loosen tape from bottom roller and pull old chart from the mechanism.

To install new chart:

1. Turn mechanism upside down with knob to the right. Place new chart, printed side down, on opposite side of mechanism and feed the end of the chart between the guard plate and the panel, then around the roller nearest the panel and out the other side. Place mechanism on its side with the panel away from you and the knob to the right.

2. Remove the covering from the scotch tape attached to the chart and attach to the top roller. Be sure to center paper between the two end discs before attaching. Smooth tape out by rubbing with the fingers and press firmly to the roller. With the mechanism in the same position, roll the chart onto the top roller until the end of the chart is even with the front panel.

3. While holding the end of the paper tightly, revolve the knob until the paper is wound tight on the roller. While holding the knob, pull the end of the chart toward you about even with the center of the bottom roller and hold in this position by pressing against the top roller.

Revolve the bottom roller a few turns toward the paper until it runs back against its spring tension, then wind it ten complete turns toward the paper and hold in this position.

4. Remove the covering from the scotch tape and attach to the bottom roller, being sure to center the paper between the end discs of the roller. Smooth out tape and press firmly to roller.

5. If the paper is either too tight or too loose, the tape may be pulled away from the roller and the tension adjusted as desired.

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
00A	8	1	39				S	2-3	1	23
01-A	8	1	36				S	2-3	1	23
0A2	22	2	33	147			S	5	1	5
0A3	15	2	37				S	5	1	5
0A4		1	41				S	5	4	5
0B2	17	2	19	457			S	1	1	1
0B3	18	2	40				S	5	1	5
0C3	18	2	35				S	5	1	5
0D3	22	2	38				S	5	1	5
0Y4		1	45				S	5	4	5
0Z4-P 1		1	46				S	3-5	4	3
0Z4-P 2		1	46						4	5
1	9	1	46		H	4	S	2	1	2
1A3	4	1	0	2	H	7	S	6	3	6
1A4	5	1	31				S	C-2-3	2	C23
1A5	4	2	33				S	3-4-5	2	345
1A6	5	1	30				S	C-2-3-4-5	2	C2345
1A7	4	2	32				S	C-3-4-5-6	2	C3456
1AB5	4	1	34	8			S	2-3-6	2	236
1B4-951	5	1	32				S	C-2-3	2	C23
1B5-25S-TRI	5	1	30				S	2-3-4-5	2	25
1B5-25S-DIO 1	5	1	0						3	3
1B5-25S-DIO 2	5	1	0						3	4
1B7	4	2	36				S	C-3-4-5-6	2	C3456
1B8-TRI	4	2	35				S	C-3-4-5-6-8	2	C6
1B8-PEN	4	2	35						2	345
1B8-DIO	4	2	0						3	8

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir Sel	Toggles Up (Separately)	Cir Sel.	Toggles Up (Together)
1C5	4	2	36				S	3-4-5	2	345
1C6	5	1	32				S	C-2-3-4-5	2	C2345
1C7	5	2	32				S	C-3-4-5-6	2	C3456
1C21	13	2	33				S	5-7	1	57
1D5	5	2	32				S	C-3-4	2	C34
1D7	5	2	29				S	C-3-4-5-6	2	C3456
1D8-TRI	4	2	32				S	C-3-4-5-6-8	2	C6
1D8-PEN	4	2	36						2	345
1D8-DIO	4	2	0						3	8
1E4	4	2	37				S	3-5	2	35
1E5	5	2	31				S	C-3-4	2	C34
1E7-PEN 1	5	2	35				S	3-4-5-6-8	2	348
1E7-PEN 2	5	2	35						2	568
1F4	5	1	33				S	2-3-4	2	234
1F5	5	2	34				S	3-4-5	2	345
1F6-PEN	5	1	32				S	C-2-3-4-5	2	C23
1F6-DIO 1	5	1	0						3	4
1F6-DIO 2	5	1	0						3	5
1F7-PEN	5	2	27				S	C-3-4-5-6	2	C36
1F7-DIO 1	5	2	0						3	4
1F7-DIO 2	5	2	0						3	5
1G4	4	2	37				S	3-5	2	35
1G5	5	2	36				S	3-4-5	2	345
1G6-TRI 1	4	2	35				S	3-4-5-6	2	34
1G6-TRI 2	4	2	35						2	56
1H4	5	2	32				S	3-5	2	35
1H5-TRI	4	2	31				S	C-3-5	2	C3
1H5-DIO	4	2	0						3	5

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
1H6-TRI	5	2	28				S	3-4-5-6	2	36
1H6-DIO 1	5	2	0						3	4
1H6-DIO 2	5	2	0						3	5
1J5	5	2	32				S	3-4-5	2	345
1J6-TRI 1	5	2	31				S	3-4-5-6	2	34
1J6-TRI 2	5	2	31						2	56
1L4	4	1	34	5			S	2-3-6	2	236
1LA4	4	1	35				S	2-3-6	2	236
1LA6	4	1	32				S	2-3-4-5-6	2	23456
1LB4	4	1	34				S	2-3-6	2	236
1LC5	4	1	34				S	2-3-4-6	2	2346
1LC6	4	1	32				S	2-3-4-5-6	2	23456
1LD5-PEN	4	1	36				S	2-3-4-6	2	236
1LD5-DIO	4	1	0						3	4
1LE3	4	1	35				S	2-6	2	26
1LH4-TRI	4	1	35				S	2-4-6	2	26
1LH4-DIO	4	1	0						3	4
1LN5	4	1	38				S	2-3-4-6	2	2346
1N5	4	2	35				S	C-3-4	2	C34
1N6-PEN	4	2	35				S	3-4-5-6	2	345
1N6-DIO	4	2	0						3	6
1P5	4	2	31				S	C-3-4	2	C34
1Q5	4	2	38				S	3-4-5	2	345
1R4	4	1	0		H	8	S	2-4	3	4
1R5	4	5	34	1			S	2-3-4-6	2	2346
1S4	4	5	37	16			S	2-3-4	2	234
1S5-PEN	4	1	30				S	3-4-5-6	2	456
1S5-DIO	4	1	0						3	3

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
1SA6	4	2	35				S	3-4-6-8	2	3468
1SB6-PEN	4	2	34				S	3-4-5-8	2	348
1SB6-DIO	4	2	0						3	5
1T4	4	5	35	1			S	2-3-6	2	236
1T5	4	2	38				S	3-4-5	2	345
1U4	4	1	30	5			S	2-3-6	2	236
1U5-PEN	4	7	27				S	2-3-4-6	2	236
1U5-DIO	4	7	0						3	4
1V	9	1	45		H	4	S	2	1	2
2A3	6	1	46				S	2-3	1	23
2A4-T 1	6	2	46				S	3-5	1	3
2A4-T 2	6	2	46						1	5
2A5	6	1	41		H	6	S	2-3-4	1	234
2A6-TRI	6	1	41		H	6	S	C-2-3-4	1	C2
2A6-DIO 1	6	1	0						3	3
2A6-DIO 2	6	1	0						3	4
2A7	6	1	41		H	7	S	C-2-3-4-5	1	C2345
2B6-IN	6	1	35		H	7	S	2-3-4-5	1	34
2B6-OUT	6	1	42						1	2345
2B7-PEN	6	1	34		H	7	S	C-2-3-4-5	1	C23
2B7-DIO 1	6	1	0						3	4
2B7-DIO 2	6	1	0						3	5
2C4	6	1	44		H	7	S	3-5	1	35
2C21-TRI 1	9	1	40		H	7	S	C-3-4-5	1	45
2C21-TRI 2	9	1	40						1	C3
2C22	9	2	45		H	7	S	C	1	C
2C22			For Inter-Element Leakage connect lead to each top cap in succession. For Quality Test connect lead to both top caps in parallel.							
2D21	9	3	50	5	H	4	S	1-6-7	1	167

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
2E5	6	1	34		H	6	S	2-3-4	1	234
2E24	9	2	45	146			S	C-3-5	1	C35
2E26	9	2	44		H	7	S	C-3-5	1	C35
2G5	6	1	34		H	6	S	2-3-4	1	234
2S-4S-P 1	6	1	0		H	5	S	2-3	3	2
2S-4S-P 2	6	1	0						3	3
2V3	6	2	16				S	C	4	C
2W3	6	2	36				S	4	1	4
2X2	6	1	32				S	C	1	C
2Y2	6	1	32				S	C	4	C
2Z2	6	1	30				S	2	1	2
3A4	6	1	35	25			S	3-4-6	2	346
3A5-TRI 1	6	1	37	4			S	2-3-5-6	2	56
3A5-TRI 2	6	1	37	4					2	23
3A8-TRI	6	2	34	1			S	C-3-4-5-6-8	2	56
3A8-PEN	6	2	37	1					2	C34
3A8-DIO	6	2	0	1					3	8
3P5	6	2	36	8			S	3-4-5	2	345
3B7-TRI 1	6	1	37	4			S	2-3-6-7	2	23
3B7-TRI 2	6	1	37	4					2	67
3C5	6	2	36	8			S	3-4-5	2	345
3D6	6	1	39	7			S	2-3-6	2	236
3LF4	6	1	36	7			S	2-3-6	2	236
3Q4	6	1	38	25			S	3-4-6	2	346
3Q5	6	2	34	8			S	3-4-5	2	345
3S4	6	1	35	56			S	2-3-4	2	234
3V4	7	1	41	5			S	2-3-6	2	236
4A6-TRI 1	5	8	37				S	3-4-5-6	2	34
4A6-TRI 2	5	8	37						2	56

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
5R4-P1	8	2	41				S	4-6	1	6
5R4-P 2	8	2	41						1	4
5T4-P 1	8	2	43				S	4-6	1	4
5T4-P 2	8	2	43						1	6
5U4-P 1	8	2	41				S	4-6	1	4
5U4-P 2	8	2	41						1	6
5V4-P 1	8	2	46				S	4-6	1	4
5V4-P 2	8	2	46						1	6
5W4-P 1	8	2	36				S	4-6	1	4
5W4-P 2	8	2	36						1	6
5X3-P 1	8	1	41				S	2-3	1	2
5X3-P 2	8	1	41						1	3
5X4-P 1	8	8	43				S	3-5	1	3
5X4-P 2	8	8	43						1	5
5Y3-P 1	8	2	36				S	4-6	1	4
5Y3-P 2	8	2	36						1	6
5Y4-P 1	8	8	35				S	3-5	1	3
5Y4-P 2	8	8	35						1	5
5Z3-P 1	8	1	41				S	2-3	1	2
5Z3-P 2	8	1	41						1	3
5Z4-P 1	8	2	44				S	4-6	1	4
5Z4-P 2	8	2	44						1	6
6A3	9	1	45				S	2-3	1	23
6A4	9	1	43				S	2-3-4	1	234
6A5	9	2	43	8			S	3-5	1	35
6A6-TRI 1	9	1	41		H	7	S	2-3-5-6	1	23
6A6-TRI 2	9	1	41						1	56
6A7	9	1	41		H	7	S	C-2-3-4-5	1	C2345

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6A8	9	2	42		H	7	S	C-3-4-5-6	1	C3456
6AB5	9	1	24		H	6	S	2-3-4	1	234
6AB6	9	2	37		H	7	S	3-4-5	1	345
6AB7	9	2	45		H	7	S	3-4-6-8	1	3468
6AC5	9	2	42		H	7	S	3-5	1	35
6AC6	9	2	42		H	7	S	3-4-5	1	345
6AC7	9	2	47		H	7	S	3-4-6-8	1	3468
6AD5	9	2	39		H	7	S	3-5	1	35
6AD6-TAR	9	2	0		H	7	S	3-4-5	4	5
6AD6-CON 1	9	2	0						4	35
6AD6-CON 2	9	2	0						4	45
6AD7-TRI	9	2	7		H	7	S	1-3-4-5-6	1	16
6AD7-PEN	9	2	41						1	345
6AE5	9	2	44		H	7	S	3-5	1	35
6AE6	9	2	42		H	7	S	3-4-5	1	345
6AE7-TRI 1	9	2	42		H	7	S	3-4-6	1	34
6AE7-TRI 2	9	2	42						1	36
6AF5	9	2	44		H	7	S	3-5	1	35
6AF6-TAR	9	2	0		H	7	S	3-4-5	4	5
6AF6-CON 1	9	2	0						4	35
6AF6-CON 2	9	2	0						4	45
6AG5	9	3	38		H	4	S	1-5-6	1	156
6AG7	9	2	47		H	7	S	1-4-6-8	1	1468
6AH7-TRI 1	9	8	37		H	7	S	1-3-5-6	1	13
6AH7-TRI 2	9	8	37						1	56
6AK5	9	3	44	7	H	4	S	1-5-6	1	156
6AK6	9	3	43		H	4	S	1-2-5-6	1	1256
6AL5-DIO 1	9	3	0		H	4	S	2-6-7	3	7
6AL5-DIO 2	9	3	0						3	2

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6AL6	9	2	45		H	7	S	C-4-5	1	C45
6AQ5	9	3	42	7	H	4	S	1-5-6	1	156
6AQ6-AMP	9	3	40		H	4	S	1-5-6-7	1	17
6AQ6-DIO 1	9	3	0						3	5
6AQ6-DIO 2	9	3	0						3	6
6AR6	9	6	45		H	8	S	3-5-7	1	357
6AS6	9	3	44		H	4		1-5-6-7	1	1567
6AS7-TRI 1	9	7	46		H	8	S	1-2-4-5	1	12
6AS7-TRI 2	9	7	46						1	45
6AT6-TRI	9	3	41		H	4	S	1-5-6-7	1	17
6AT6-DIO 1	9	3	0						3	5
6AT6-DIO 2	9	3	0						3	6
6B4	9	2	45				S	3-5	1	35
6B5	9	1	36		H	6	S	2-3-4	1	234
6B6-TRI	9	2	42		H	7	S	C-3-4-5	1	C3
6B6-DIO 1	9	2	0						3	4
6B6-DIO 2	9	2	0						3	5
6B7-PEN	9	1	34		H	7	S	C-2-3-4-5	1	C23
6B7-DIO 1	9	1	0						3	4
6B7-DIO 2	9	1	0						3	5
6B8-PEN	9	2	32		H	7	S	C-3-4-5-6	1	C36
6B8-DIO 1	9	2	0						3	4
6B8-DIO 2	9	2	0						3	5
6BA6	9	3	45		H	4	S	1-2-5-6	1	1256
6BE6	9	3	45		H	4	S	1-5-6-7	1	1567
6BG6	9	2	45		H	7	S	C-5-8	1	C58
6C4	9	3	44	1	H	4	S	5-6	1	56

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6C5	9	2	41		H	7	S	3-5	1	35
6C6	9	1	42		H	6	S	C-2-3-4	1	C234
6C7-TRI	9	1	42		H	7	S	C-2-4-5	1	C2
6C7-DIO 1	9	1	0						3	4
6C7-DIO 2	9	1	0						3	5
6C8-TRI 1	9	2	36		H	7	S	C-3-5-6	1	C3
6C8-TRI 2	9	2	36						1	56
6D4	9	3	44		H	4	S	1-7	1	17
6D5	9	2	40		H	7	S	3-5	1	35
6D6	9	1	40		H	6	S	C-2-3-4	1	C234
6D7	9	1	43		H	7	S	C-2-3-4	1	C234
6D8	9	2	41		H	7	S	C-3-4-5-6	1	C3456
6E5	9	1	34		H	6	S	2-3-4	1	234
6E6-TRI 1	9	1	41		H	7	S	2-3-5-6	1	23
6E6-TRI 2	9	1	41						1	56
6E7	9	1	42		H	7	S	C-2-3-4	1	C234
6F4	9	1	47	45	H	6	S	2-3	1	23
6F5	9	2	43		H	7	S	C-4	1	C4
6F6	9	2	40		H	7	S	3-4-5	1	345
6F7-TRI	9	1	8		H	7	S	C-2-3-4-5	1	45
6F7-PEN	9	1	38						1	C23
6F8-TRI 1	9	2	43		H	7	S	C-3-5-6	1	C3
6F8-TRI 2	9	2	43						1	56
6G5	9	1	34		H	6	S	2-3-4	1	234
6G6	9	2	42		H	7	S	3-4-5	1	345
6H4	9	2	0		H	7	S	4	3	4
6H5	9	1	34		H	6	S	2-3-4	1	234
6H6-DIO 1	9	2	0		H	7	S	3-5	3	3
6H6-DIO 2	9	2	0						3	5

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6J4	9	3	47	15	H	4	S	6-7	1	67
6J5	9	2	45		H	7	S	3-5	1	35
6J6-TRI 1	9	3	46		H	4	S	1-2-5-6	1	25
6J6-TRI 2	9	3	46						1	16
6J7	9	2	42		H	7	S	C-3-4-5	1	C345
6J8-TRI	9	2	37		H	7	S	C-3-4-5-6	1	56
6J8-HEP	9	2	41						1	C345
6K5	9	2	43		H	7	S	C-3	1	C3
6K6	9	2	41		H	7	S	3-4-5	1	345
6K7	9	2	40		H	7	S	C-3-4-5	1	C345
6K8-TRI	9	2	45		H	7	S	C-3-4-5-6	1	56
6K8-HEX	9	2	45						1	C345
6L5	9	2	44		H	7	S	3-5	1	35
6L6	9	2	45		H	7	S	3-4-5	1	345
6L7	9	2	44		H	7	S	C-3-4-5	1	C345
6N4	9	3	42	7	H	4	S	1-5	1	15
6N5	9	1	24		H	6	S	2-3-4	1	234
6N6	9	2	36		H	7	S	3-4-5	1	345
6N7-TRI 1	9	2	42		H	7	S	3-4-5-6	1	34
6N7-TRI 2	9	2	42						1	56
6P5	9	2	39		H	7	S	3-5	1	35
6P7-TRI	9	2	8		H	3	S	C-4-5-6-7	1	67
6P7-PEN	9	2	34						1	C45
6Q6-TRI	9	2	40		H	7	S	C-3-5	1	C3
6Q6-DIO	9	2	0						3	5
6Q7-TRI	9	2	42		H	7	S	C-3-4-5	1	C 3
6Q7-DIO 1	9	2	0						3	4
6Q7-DIO 2	9	2	0						3	5

Tube Type	Fil Sel	Fil Ret	Tube Sel	Tog Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog Up	Cir Sel.	Toggles Up (Separately)	Cir Sel.	Toggles Up (Together)
6R6	9	1	37		H	8	S	2-3-6	1	236
6R7-TRI	9	2	38		H	7	S	C-3-4-5	1	C3
6R7-DIO 1	9	2	0						3	4
6R7-DIO 2	9	2	0						3	5
6S6	9	2	46		H	7	S	C-4-8	1	C48
6S7	9	2	39		H	7	S	C-3-4-5	1	C345
6S8-TRI	9	7	41		H	8	S	C-1-3-4-6	1	C6
6S8-DIO 1	9	7	0						3	3
6S8-DIO 2	9	7	0						3	4
6S8-DIO 3	9	7	0						3	1
6SA7	9	2	45		H	7	S	1-3-4-5-8	1	13458
6SB7	9	2	46		H	7	S	1-3-4-5-8	1	13458
6SC7-TRI 1	9	8	41		H	7	S	2-3-4-5	1	23
6SC7-TRI 2	9	8	41						1	45
6SD7	9	2	45		H	7	S	1-3-4-6-8	1	13468
6SE7	9	2	46		H	7	S	3-4-6-8	1	3468
6SF5	9	8	43		H	7	S	3-5	1	35
6SF7-PEN	9	8	41		H	7	S	2-4-5-6	1	246
6SF7-DIO	9	8	0						3	5
6SG7	9	2	46		H	7	S	4-6-8	1	468
6SH7	9	2	46		H	7	S	4-6-8	1	468
6SJ7	9	2	43		H	7	S	3-4-6-8	1	3468
6SK7	9	2	42		H	7	S	3-4-6-8	1	3468
6SL7-TRI 1	9	8	42		H	7	S	1-2-4-5	1	45
6SL7-TRI 2	9	8	42						1	12
6SN7-TRI 1	9	8	43		H	7	S	1-2-4-5	1	45
6SN7-TRI 2	9	8	43						1	12

Tube Type	Fil. Sel.	Fil. Ret	Tube Sel	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog Up	Cir. Sel.	Toggles Up (Separately)	Cir Sel.	Toggles Up (Together)
6SQ7-TRI	9	8	41		H	7	S	2-4-5-6	1	26
6SQ7-DIO-1	9	8	0						3	4
6SQ7-DIO 2	9	8	0						3	5
6SR7-TRI	9	8	40		H	7	S	2-4-5-6	1	26
6SR7-DIO 1	9	8	0						3	4
6SR7-DIO 2	9	8	0						3	5
6SS7	9	2	42		H	7	S	3-4-6-8	1	3468
6ST7-TRI	9	8	41		H	7	S	2-4-5-6	1	26
6ST7-DIO 1	9	8	0						3	5
6ST7-DIO 2	9	8	0						3	4
6SU7-TRI 1	9	7	38		H	8	S	1-2-4-5	1	12
6SU7-TRI 2	9	7	38						1	45
6SV7-PEN	9	7	44		H	8	S	2-4-5-6	1	246
6SV7-DIO	9	7	0						3	5
6SZ7-TRI	9	7	40		H	8	S	2-4-5-6	1	26
6SZ7-DIO 1	9	7	0						3	5
6SZ7-DIO 2	9	7	0						3	4
6T5	9	1	34		H	6	S	2-3-4	1	234
6T7-TRI	9	2	40		H	7	S	C-3-4-5	1	C3
6T7-DIO 1	9	2	0						3	4
6T7-DIO 2	9	2	0						3	5
6U5	9	1	35		H	6	S	2-3-4	1	234
6U6	9	2	46		H	7	S	3-4-5	1	345
6U7	9	2	42		H	7	S	C-3-4-5	1	C345
6V6	9	2	43		H	7	S	3-4-5	1	345
6V7-TRI	9	2	41		H	7	S	C-3-4-5	1	C3
6V7-DIO 1	9	2	0						3	4
6V7-DIO 2	9	2	0						3	5

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6W5-P 1	9	2	44		H	7	S	3-5	1	3
6W5-P 2	9	2	44						1	5
6W6	9	2	43		H	7	S	3-4-5	1	345
6W7	9	2	43		H	7	S	C-3-4-5	1	C345
6X4-P 2	9	3	42		H	4	S	1-6	1	1
6X4-P-1	9	3	42						1	6
6X5-P 1	9	2	42		H	7	S	3-5	1	3
6X5-P 2	9	2	42						1	5
6Y5-P 1	9	1	47		H	6	S	3-5	1	3
6Y5-P 2	9	1	47						1	5
6Y6	9	2	46		H	7	S	3-4-5	1	345
6Y7-TRI 1	9	2	40		H	7	S	3-4-5-6	1	34
6Y7-TRI 2	9	2	40						1	56
6Z3	9	1	46		H	4	S	2	1	2
6Z4-P 1	9	1	42		H	5	S	2-3	1	2
6Z4-P 2	9	1	42						1	3
6Z5-P-1	11	2	42	1	H	6	S	3-5	1	3
6Z5-P 2	11	2	42	1					1	5
6Z7-TRI 1	9	2	41		H	7	S	3-4-5-6	1	34
6Z7-TRI 2	9	2	41						1	56
6ZY5-P 1	9	2	40		H	7	S	3-5	1	3
6ZY5-P 2	9	2	40						1	5
7A4	9	1	44		H	8	S	2-6	1	26
7A5	9	1	46		H	8	S	2-3-6	1	236
7A6-DIO 1	9	1	0		H	8	S	3-6	3	3
7A6-DIO 2	9	1	0						3	6
7A7	9	1	44		H	8	S	2-3-4-6	1	2346
7A8	9	1	42		H	8	S	2-3-4-5-6	1	23456
7AG7	9	1	46		H	8	S	2-3-4-6	1	2346

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
7B4	9	1	44		H	8	S	2-6	1	26
7B5	9	1	42		H	8	S	2-3-6	1	236
7B6-TRI	9	1	43		H	8	S	2-3-5-6	1	23
7B6-DIO 1	9	1	0						3	5
7B6-DIO 2	9	1	0						3	6
7B7	9	1	42		H	8	S	2-3-4-6	1	2346
7B8	9	1	44		H	8	S	2-3-4-5-6	1	23456
7C4	9	1	0		H	8	S	4	3	4
7C5	9	1	44		H	8	S	2-3-6	1	236
7C6-TRI	9	1	41		H	8	S	2-3-5-6	1	23
7C6-DIO 1	9	1	0						3	5
7C6-DIO 2	9	1	0						3	6
7C7	9	1	45		H	8	S	2-3-4-6	1	2346
7E5	9	2	44	567	H	8	S	1-3	1	13
7E6-TRI	9	1	43		H	8	S	2-3-5-6	1	23
7E6-DIO 1	9	1	0						3	5
7E6-DIO 2	9	1	0						3	6
7E7-PEN	9	1	40		H	8	S	2-3-4-5-6	1	256
7E7-DIO 1	9	1	0						3	3
7E7-DIO 2	9	1	0						3	4
7F7-TRI 1	9	1	42		H	8	S	3-4-5-6	1	34
7F7-TRI 2	9	1	42						1	56
7F8-TRI 1	9	2	39		H	7	S	1-3-6-8	2	13
7F8-TRI 2	9	2	39						2	68
7G7	9	1	47		H	8	S	2-3-4-6	1	2346
7H7	9	1	45		H	8	S	2-3-4-6	1	2346
7J7-TRI	9	1	40		H	8	S	2-3-4-5-6	1	34
7J7-HEX	9	1	45						1	2456

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel	Tog Down	Leakage or Short Test				Quality Test	
					Cath-Htr		Inter-Element			
					Cir Sel.	Tog Up	Cir Sel	Toggles Up (Separately)	Cir Sel.	Toggles Up (Together)
7K7-TRI	9	1	43		H	8	S	3-4-5-6	1	34
7K7-DIO 1	9	1	0						3	6
7K7-DIO 2	9	1	0						3	5
7L7	9	1	46		H	8	S	2-3-4-6	1	2346
7N7-TRI 1	9	1	44		H	8	S	3-4-5-6	1	34
7N7-TRI 2	9	1	44						1	56
7Q7	9	1	44		H	8	S	2-3-4-5-6	1	23456
7R7-PEN	9	1	46		H	8	S	2-3-4-5-6	1	256
7R7-DIO 1	9	1	0						3	3
7R7-DIO 2	9	1	0						3	4
7S7-HEP	9	1	46		H	8	S	2-3-4-5-6	1	2456
7S7-TRI	9	1	40						1	34
7T7	9	1	45		H	8	S	2-3-4-6	1	2346
7V7	9	1	46		H	8	S	2-3-4-6	1	2346
7W7	9	1	42	7	H	8	S	2-3-5-6	1	2356
7X7-TRI	9	1	41		H	8	S	2-3-5-6	1	23
7X7-DIO 1	9	1	0						3	5
7X7-DIO 2	9	1	0						3	6
7Y4-P 1	9	1	43		H	8	S	3-6	1	3
7Y4-P 2	9	1	43						1	6
7Z4-P 1	9	1	37		H	8	S	3-6	1	6
7Z4-P 2	9	1	37						1	3
10	10	1	38				S	2-3	1	23
12A	8	1	42				S	2-3	1	23
12A5	11	1	41	6	H	7	S	2-3-4	1	234
12A6	11	2	41		H	7	S	3-4-5	1	345
12A7-REC	11	1	46		H	7	S	C-2-3-5	1	5
12A7-PEN	11	1	40						1	C23

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
12A8	11	2	43		H	7	S	C-3-4-5-6	1	C3456
12AH7-TRI 1	11	8	37		H	7	S	1-3-5-6	1	13
12AH7-TRI 2	11	8	37						1	56
12AT6-TRI	11	3	42		H	4	S	1-5-6-7	1	17
12AT6-DIO-1	11	3	0						3	6
12AT6-DIO 2	11	3	0						3	5
12B7	11	1	43		H	8	S	2-3-4-6	1	2346
12B8-TRI	11	2	45		H	7	S	C-3-4-5-8	1	58
12B8-PEN	11	2	43						1	C34
12BA6	11	3	46		H	4	S	1-2-5-6	1	1256
12BE6	11	3	45		H	4	S	1-5-6-7	1	1567
12BF6-TRI	11	3	41		H	4	S	1-5-6-7	1	17
12AT6-DIO 1	11	3	0						3	5
12BF6-DIO 2	11	3	0						3	6
12C8-PEN	11	2	36		H	7	S	C-3-4-5-6	1	C36
12C8-DIO 1	11	2	0						3	4
12C8-DIO 2	11	2	0						3	5
12E5	11	2	40		H	7	S	3-5	1	35
12F5	11	2	43		H	7	S	C-4	1	C4
12H6-DIO 1	11	2	0		H	7	S	3-5	3	5
12H6-DIO 2	11	2	0						3	3
12J5	11	2	44		H	7	S	3-5	1	35
12J7	11	2	42		H	7	S	C-3-4-5	1	C345
12K7	11	2	41		H	7	S	C-3-4-5	1	C345
12K8-TRI	11	2	46		H	7	S	C-3-4-5-6	1	56
12K8-HEX	11	2	46						1	C345
12L8-PEN 1	11	7	43		H	6	S	1-3-4-5-8	1	158
12L8-PEN 2	11	7	43						1	345

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
12Q7-TRI	11	2	43		H	7	S	C-3-4-5	1	C3
12Q7-DIO 1	11	2	0						3	4
12Q7-DIO 2	11	2	0						3	5
12SA7	11	2	45		H	7	S	1-3-4-5-8	1	13458
12SC7-TRI 1	11	8	41		H	7	S	2-3-4-5	1	23
12SC7-TRI 2	11	8	41						1	45
12SF5	11	8	44		H	7	S	3-5	1	35
12SF7-PEN	11	8	41		H	7	S	2-4-5-6	1	246
12SF7-DIO	11	8	0						3	5
12SG7	11	2	46		H	7	S	4-6-8	1	468
12SH7	11	2	46		H	7	S	4-6-8	1	468
12SJ7	11	2	45		H	7	S	3-4-6-8	1	3468
12SK7	11	2	42		H	7	S	3-4-6-8	1	3468
12SL7-TRI 1	11	8	42		H	7	S	1-2-4-5	1	45
12SL7-TRI 2	11	8	42						1	12
12SN7-TRI 1	11	8	44		H	7	S	1-2-4-5	1	45
12SN7-TRI 2	11	8	44						1	12
12SQ7-TRI	11	8	43		H	7	S	2-4-5-6	1	26
12SQ7-DIO 1	11	8	0						3	4
12SQ7-DIO 2	11	8	0						3	5
12SR7-TRI	11	8	41		H	7	S	2-4-5-6	1	26
12SR7-DIO 1	11	8	0						3	4
12SR7-DIO 2	11	8	0						3	5
12SW7-TRI	11	7	41		H	8	S	2-4-5-6	1	26
12SW7-DIO 1	11	7	0						3	5
12SW7-DIO 2	11	7	0						3	4
12SX7-TRI 1	11	7	42		H	8	S	1-2-4-5	1	12
12SX7-TRI 2	11	7	42						1	45

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
12Z3	11	1	46		H	4	S	2	1	2
12Z5-P 1	11	2	42	1	H	6	S	3-5	1	3
12Z5-P 2	11	2	42	1					1	5
14	11	1	40		H	5	S	C-2-3	1	C23
14A4	11	1	44		H	8	S	2-6	1	26
14A5	11	1	42		H	8	S	2-3-6	1	236
14A7	11	1	44		H	8	S	2-3-4-6	1	2346
14B6-TRI	11	1	44		H	8	S	2-3-5-6	1	23
14B6-DIO 1	11	1	0						3	5
14B6-DIO 2	11	1	0						3	6
14B8	11	1	43		H	8	S	2-3-4-5-6	1	23456
14C5	11	1	44		H	8	S	2-3-6	1	236
14C7	11	1	44		H	8	S	2-3-4-6	1	2346
14E6-TRI 1	11	1	41		H	8	S	2-3-5-6	1	23
14E6-DIO 1	11	1	0						3	5
14E6-DIO 2	11	1	0						3	6
14E7-PEN	11	1	40		H	8	S	2-3-4-5-6	1	256
14E7-DIO 1	11	1	0						3	4
14E7-DIO 2	11	1	0						3	3
14F7-TRI 1	11	1	43		H	8	S	3-4-5-6	1	34
14F7-TRI 2	11	1	43						1	56
14H7	11	1	46		H	8	S	2-3-4-6	1	2346
14J7-TRI	11	1	39		H	8	S	2-3-4-5-6	1	34
14J7-HEX	11	1	45						1	2456
14N7-TRI 1	11	1	44		H	8	S	3-4-5-6	1	34
14N7-TRI 2	11	1	44						1	56
14Q7	11	1	45		H	8	S	2-3-4-5-6	1	23456

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
14R7-PEN	11	1	46		H	8	S	2-3-4-5-6	1	256
14R7-DIO 1	11	1	0						3	3
14R7-DIO 2	11	1	0						3	4
14S7-TRI	11	1	41		H	8	S	2-3-4-5-6	1	34
14S7-HEP	11	1	46						1	2456
14W7	11	1	42	4	H	8	S	2-3-5-6	1	2356
14Y4-P 1	11	1	43		H	8	S	3-6	1	3
14Y4-P 2	11	1	43						1	6
14Z3	11	1	46		H	4	S	2	1	2
15	5	1	28		H	5	S	C-2-3	2	C23
17	11	1	37		H	5	S	2-3	1	23
18	11	1	42		H	6	S	2-3-4	1	234
19-TRI 1	5	1	34					2-3-4-5	2	23
19-TRI 2	5	1	34						2	45
20	7	1	27				S	2-3	2	23
22	7	1	22				S	C-2-3	2	C23
24A	6	1	40		H	5	S	C-2-3	1	C23
25-TRI	5	1	30				S	2-3-4-5	2	25
25-DIO 1	5	1	0						3	3
25-DIO 2	5	1	0						3	4
25A6	13	2	43		H	7	S	3-4-5	1	345
25A7-REC	13	2	44		H	7	S	3-4-5-6	1	6
25A7-PEN	13	2	42						1	345
25AC5	13	2	43		H	7	S	3-5	1	35
25B5	13	1	41		H	6	S	2-3-4	1	234
25B6	13	2	45		H	7	S	3-4-5	1	345
25B8-TRI	13	2	44		H	7	S	C-3-4-5-8	1	58
25B8-PEN	13	2	44						1	C34

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
25C6	13	2	45		H	7	S	3-4-5	1	345
25D8-TRI	13	2	42		H	7	S	C-3-4-5-6-8	1	56
25D8-PEN	13	2	44						1	C34
25D8-DIO	13	2	0						3	8
25L6	13	2	46		H	7	S	3-4-5	1	345
25N6	13	2	41		H	7	S	3-4-5	1	345
25S-1B5-TRI	5	1	30				S	2-3-4-5	2	25
25S-1B5-DIO 1	5	1	0						3	3
25S-1B5-DIO 2	5	1	0						3	4
25X6-P 1	13	2	43		H	7	S	3-5	1	3
25X6-P 2	13	2	43						1	5
25Y5-P 1	13	1	45		H	6	S	2-5	1	2
25Y5-P 2	13	1	45						1	5
25Z3	13	1	46		H	4	S	2	1	2
25Z4	13	2	47		H	7	S	5	1	5
25Z5-P 1	13	1	46		H	6	S	2-5	1	2
25Z5-P 2	13	1	46						1	5
25Z6-P 1	13	2	46		H	7	S	3-5	1	3
25Z6-P 2	13	2	46						1	5
26	4	1	36				S	2-3	1	23
26A7-PEN 1	13	6	46		H	7	S	1-3-4-5	1	15
26A7-PEN 2	13	6	46						1	345
27	6	1	37		H	5	S	2-3	1	23
28D7-P-1	13	1	41		H	8	S	2-3-4-5-7	2	357
28D7-P 2	13	1	41						2	234
29-TRI 1	6	1	35		H	6	S	2-3-4	1	23
29-TRI 2	6	1	35						1	24

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir Sel.	Toggles Up (Together)
30	5	1	32				S	2-3	2	23
30S	5	1	32				S	C-3	2	C3
31	5	1	33				S	2-3	2	23
32	5	1	32				S	C-2-3	2	C23
32L7-REC	14	2	46		H	7	S	3-4-5-6	1	6
32L7-TET	14	2	45						1	345
33	5	1	35				S	2-3-4	2	234
34	5	1	31				S	C-2-3	2	C23
35-51	6	1	40		H	5	S	C-2-3	1	C23
35A5	14	1	46		H	8	S	2-3-6	1	236
35L6	14	2	47		H	7	S	3-4-5	1	345
35W4	14	3	46	6	H	4	S	5	1	5
35Y4	13	1	45	4	H	8	S	2	1	2
35Z3	14	1	47		H	8	S	2	1	2
35Z4	14	2	46		H	7	S	5	1	5
35Z5	14	2	47	3	H	7	S	5	1	5
35Z6-P 1	14	2	47		H	7	S	3-5	1	3
35Z6-P 2	14	2	47						1	5
36	9	1	41		H	5	S	C-2-3	1	C23
37	9	1	39		H	5	S	2-3	1	23
38	9	1	40		H	5	S	C-2-3	1	C23
39-44	9	1	37		H	5	S	C-2-3	1	C23
40	8	1	38				S	2-3	1	23
40Z5	15	2	43	3	H	7	S	5	1	5
41	9	1	43		H	6	S	2-3-4	1	234
42	9	1	43		H	6	S	2-3-4	1	234
43	13	1	46		H	6	S	2-3-4	1	234
44-39	9	1	37		H	5	S	C-2-3	1	C23

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
45	6	1	41				S	2-3	1	23
45Z3	15	1	45	2	H	7	S	6	1	6
45Z5	15	2	43	3	H	7	S	5	1	5
46	6	1	42				S	2-3-4	1	234
47	6	1	42				S	2-3-4	1	234
48	13	1	45		H	6	S	2-3-4	1	234
49	5	1	34				S	2-3-4	2	234
50	10	1	40				S	2-3	1	23
50A5	16	1	47		H	8	S	2-3-6	1	236
50B5	16	3	46	7	H	4	S	1-5-6	1	156
50C6	16	2	47		H	7	S	3-4-5	1	345
50L6	16	2	46		H	7	S	3-4-5	1	345
50Y6-P 1	16	2	46		H	7	S	3-5	1	3
50Y6-P 2	16	2	46						1	5
50Z7-P 1	16	2	46	6	H	7	S	3-5	1	3
50Z7-P 2	16	2	46	6					1	5
51-35	6	1	40		H	5	S	C-2-3	1	C23
52	9	1	43				S	2-3-4	1	234
53-TRI 1	6	1	42		H	7	S	2-3-5-6	1	23
53-TRI 2	6	1	42						1	56
55-TRI	6	1	34		H	6	S	C-2-3-4	1	C2
55-DIO 1	6	1	0						3	3
55-DIO 2	6	1	0						3	4
56	6	1	40		H	5	S	2-3	1	23
57	6	1	42		H	6	S	C-2-3-4	1	C234
58	6	1	41		H	6	S	C-2-3-4	1	C234
59	6	1	42		H	7	S	2-3-4-5	1	2345

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
70A7-TET	18	2	44	6	H	7	S	3-4-5	1	345
70A7-REC	18	2	46	6					1	19
70L7-REC	18	2	46		H	7	S	3-4-5-8	1	8
70L7-TET	18	2	45						1	345
71A	8	1	41				S	2-3	1	23
75-TRI	9	1	41		H	6	S	C-2-3-4	1	C2
75-DIO 1	9	1	0						3	3
75-DIO 2	9	1	0						3	4
76	9	1	39		H	5	S	2-3	1	23
77	9	1	41		H	6	S	C-2-3-4	1	C234
78	9	1	41		H	6	S	C-2-3-4	1	C234
79-TRI 1	9	1	41		H	6	S	C-2-3-5	1	C5
79-TRI 2	9	1	41						1	23
80-P 1	8	1	37				S	2-3	1	2
80-P 2	8	1	37						1	3
81	10	1	33				S	2	1	2
82-P 1	6	1	47				S	2-3	1	2
82-P 2	6	1	47						1	3
83-P 1	8	1	47				S	2-3	1	2
83-P 2	8	1	47						1	3
83V-P 1	8	1	45				S	2-3	1	2
83V-P 2	8	1	45						1	3
84-P 1	9	1	42		H	5	S	2-3	1	2
84-P 2	9	1	42						1	3
85-TRI	9	1	34		H	6	S	C-2-3-4	1	C2
85-DIO 1	9	1	0						3	3
85-DIO 2	9	1	0						3	4

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
89	9	1	39		H	6	S	C-2-3-4	1	C234
99	7	1	0				S	2-3	2	23
117L7-REC	22	2	45		H	7	S	3-4-5-6	1	6
117L7-TET	22	2	46						1	345
117M7-REC	22	2	46		H	7	S	3-4-5-6	1	6
117M7-TET	22	2	46						1	345
117N7-TET	22	2	46		H	7	S	3-4-5	1	345
117N7-REC	22	2	46						1	89
117P7-TET	22	2	45		H	7	S	3-4-5	1	345
117P7-REC	22	2	47						1	89
117Z3	22	3	44	1	H	4	S	5	1	5
117Z4	22	2	46		H	7	S	5	1	5
117Z6-P 1	22	2	46	1	H	7	S	3-5	1	3
117Z6-P 2	22	2	46	1					1	5
182-482	8	1	41				S	2-3	1	23
183-483	8	1	41				S	2-3	1	23
257	7	1	33				S	2-3-4	2	234
484-485	7	1	41		H	5	S	2-3	1	23
585	10	1	39				S	2-3	1	23
586	10	1	39				S	2-3	1	23
840	5	1	33				S	C-2-3-4	2	C234
864	4	1	30				S	2-3	2	23
874	16	1	21				S	3	1	1
884	9	2	45		H	7	S	3-5	1	35
885	6	1	45		H	5	S	2-3	1	23
950	5	1	32				S	2-3-4	2	234
951-1B4	5	1	34				S	C-2-3	2	C23

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
954	9	1	40		H	6	S	C-3-4-8	1	C348
955	9	1	35		H	6	S	3-4	1	34
956	9	1	38		H	6	S	C-3-4-8	1	C348
957	3	1	26				S	3-4	2	34
958	3	1	28				S	3-4	2	34
959	3	1	32				S	C-3-4-8	2	C348
986-P 1	8	1	47				S	2-3	1	2
986-P 2	8	1	47						1	3
1201	9	2	44	567	H	8	S	1-3	1	13
1203A	9	1	0		H	8	S	4	3	4
1221	9	1	42		H	6	S	C-2-3-4	1	C234
1223	9	2	42		H	7	S	C-3-4-5	1	C345
1231	9	1	45		H	8	S	2-3-4-6	1	2346
1291-TRI 1	6	1	37	4			S	2-3-6-7	2	23
1291-TRI 2	6	1	37	4					2	67
1294	4	1	0		H	8	S	2-4	3	4
1299	6	1	41	7			S	2-3-6	2	236
1602	10	1	38				S	2-3	1	23
1603	9	1	42		H	6	S	C-2-3-4	1	C234
1609	3	1	32				S	2-3-4	2	234
1612	9	2	42		H	7	S	C-3-4-5	1	C345
1620	9	2	41		H	7	S	C-3-4-5	1	C345
1621	9	2	41		H	7	S	3-4-5	1	345
1622	9	2	45		H	7	S	3-4-5	1	345
1629	11	2	36		H	7	S	3-4-5	1	345
1631	11	2	43		H	7	S	3-4-5	1	345
1632	11	2	44		H	7	S	3-4-5	1	345

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
1633-TRI 1	I3	8	43		H	7	S	1-2-4-5	1	45
1633-TRI 2	13	8	43						1	12
1634-TRI 1	11	8	41		H	7	S	2-3-4-5	1	45
1634-TRI 2	11	8	41						1	23
1635-TRI 1	9	2	42		H	7	S	3-4-5-6	1	56
1635-TRI 2	9	2	42						1	34
1642-TRI 1	9	1	40		H	7	S	C-3-4-5	1	45
1642-TRI 2	9	1	40						1	C3
1644-PEN 1	11	7	43		H	6	S	1-3-4-5-8	1	158
1644-PEN 2	11	7	43						1	345
1654	4	1	31				S	C	4	C
1851	9	2	47		H	7	S	C-3-4-5	1	C345
1852	9	2	47		H	7	S	3-4-6-8	1	3468
1853	9	2	45		H	7	S	3-4-6-8	1	3468
2050	9	2	47		H	7	S	3-5-6	1	356
2051	9	2	47		H	7	S	3-5-6	1	356
7000	9	2	42		H	7	S	C-3-4-5	1	C345
7700	9	1	42		H	5	S	C-2-3-4	1	C234
7193	9	2	45		H	7	S	C	1	C
7193	For Inter-Element Leakage connect lead to each top cap in succession. For Quality Test connect lead to both top caps in parallel.									
8016	4	2	6				S	C	4	C
9001	9	3	42		H	4	S	1-5-6	1	156
9002	9	3	42	1	H	4	S	5-6	1	56
9003	9	3	42		H	4	S	1-5-6	1	156
9004	9	1	15		H	6	S	3	3	3
9005	7	1	0	7	H	6	S	4	3	4
9006	9	3	0	25	H	4	S	1	3	1

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
AD	9	1	47		H	4	S	2	1	2
AF-P 1	6	1	47				S	2-3	1	2
AF-P 2	6	1	47						1	3
D½	10	1	32				S	2	1	2
D1-P 1	8	1	35				S	2-3	1	2
D1-P 2	8	1	35						1	3
DE1	6	1	37		H	5	S	2-3	1	23
G2-P 1	6	1	0		H	5	S	2-3	3	2
G2-P 2	6	1	0						3	3
G4-P 1	6	1	0		H	5	S	2-3	3	2
G4-P 2	6	1	0						3	3
G84	6	1	30				S	2	1	2
H	8	1	39				S	2-3	1	23
HY113	4	1	0				S	2-3	3	23
HY115	4	1	5				S	2-3-4	3	234
HY123	4	1	0				S	2-3	3	23
HY125	4	1	5				S	2-3-4	3	234
HY145	4	1	5				S	2-3-4	3	234
HY155	4	1	5				S	2-3-4	3	234
K24	6	1	40		H	5	S	C-2-3	1	C23
KR1	9	1	46		H	4	S	2	1	2
KR2	8	1	46		H	4	S	2	1	2
KR5	9	1	42				S	2-3-4	1	234
KR25	6	1	41		H	6	S	2-3-4	1	234
KR28-P 1	9	1	42		H	5	S	2-3	1	2
KR28-P 2	9	1	42						1	3

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
KR98-P 1	9	1	42		H	5	S	2-3	1	2
KR98-P 2	9	1	42						1	3
LA	9	1	42				S	2-3-4	1	234
P861-P 1	9	1	42		H	5	S	2-3	1	2
P861-P 2	9	1	42						1	3
PZ	6	1	42				S	2-3-4	1	234
PZH	6	1	42		H	6	S	2-3-4	1	234
VR75	15	2	37				S	5	1	5
VR90	18	2	40				S	5	1	5
VR105	18	2	35				S	5	1	5
VR150	22	2	38		H		S	5	1	5
XXB-TRI 1	7	1		7			S	3-4-5-6	2	34
XXB-TRI 2	7	1		7					2	56
XXD-TRI 1	11	1	43		H	8	S	3-4-5-6	1	34
XXD-TRI 2	11	1	43						1	56
XXFM-TRI	9	1	41		H	8	S	2-3-5-6	1	23
XXFM-DIO 1	9	1	0						3	5
XXFM-DIO 2	9	1	0						3	6
XXL	9	1	45		H	8	S	2-6	1	26

SUPPLEMENT 6-52

Tube Type	Fil.-Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
OA5	2	1	0	3			S	2-4-5-7	4	47
1AE4	3	1	38	5			S	2-3-6	1	236
1AF4	4	1	32	5			S	2-3-6	2	236
1AF5-PEN	4	1	25				S	3-4-5-6	2	456
1AF5-DIO	4	1	0						3	3
1B3/8016	4	2	12				S	C	4	C
1C3	4	1	35	6			S	2-4	2	24
1LG5	4	1	35				S	2-3-4-6	2	2346
1L6	4	1	26				S	2-3-4-5-6	2	23456
1V2	2	4	0	123678			S	C	4	C
1W4	4	1	30				S	2-3-6	2	236
1X2	Turn tester "off" before inserting tube. Plug special lead into Pin #3 of 5-Pin socket and clip to top cap. Return line switch to "on" position for tube test.									
1X2	3	2	10	58			S	3	4	3
1Z2	4	1	0	3456			S	C	4	C
2C51-TRI 1	9	1	43		H	C	S	3-4-6-7	1	67
2C51-TRI 2	9	1	43						1	34
2C52-TRI 1	11	7	42		H	8	S	1-2-4-5	1	45
2C52-TRI 2	11	7	42						1	12
2C53	9	2	44		H	7	S	C-5	4	C5
2E25A	9	2	42				S	C-4-5-8	1	C458
2E30	9	3	44	7			S	1-2-5-6	1	1256
2E31	3	3	35				S	4-6-7	2	467
2E32	3	3	35				S	4-6-7	2	467
2E35	3	3	0				S	4-6-7	3	467
2E36	3	3	0				S	4-6-7	3	467
2E41	3	4	0				S	3-5-6-7	3	367
2E42	3	4	0				S	3-5-6-7	3	367
2G21-HEP	3	1	8				S	2-3-5-6-7	3	2356

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
2G21-TRI	3	1	32						2	57
2G22-HEP	3	1	8				S	2-3-5-6-7	3	2356
2G22-TRI	3	1	32						2	57
3B4	6	4	0	26			S	1-3-7	3	137
3B24	8	2	37	1			S	C	4	C
3C6-TRI 1	7	1	36	7			S	3-4-5-6	2	56
3C6-TRI 2	7	1	36	7					2	34
3D21A	11	2	46	1	H	7	S	C-4-6	1	C46
3E5	6	1	31	5			S	2-3-6	2	236
3E6	6	1	37	5			S	2-3-4-6	2	2346
3LE4	6	1	36	7			S	2-3-6	2	236
5A6	8	5	44	C8			S	1-3-6-7	1	1367
5AZ4-P 1	8	2	36				S	4-6	1	4
5AZ4-P 2	8	2	36						1	6
6AB4	9	3	45		H	4	S	1-6	1	16
6AH5	9	2	45		H	7	S	1-4-6	1	146
6AH6	9	3	47		H	4	S	1-2-5-6	1	1256
6AJ5	9	3	46		H	4	S	1-5-6	1	156
6AL7-TRI	9	2	8		H	7	S	1-3-4-5-6	2	13456
6AL7-TAR	9	2	8						4	3
6AN5	9	3	45		H	4	S	1-5-6	1	156
6AN6-DIO 1	9	1	10		H	7	S	2-3-4-5	3	5
6AN6-DIO 2	9	1	10						3	4
6AN6-DIO 3	9	1	10						3	3
6AN6-DIO 4	9	1	10						3	2
6AN7-TRI	9	4	39		H	5	S	C-1-2-7-8	1	C8
6AN7-HEX	9	4	44						1	C127
6AQ7-TRI	9	8	40		H	7	S	1-3-4-5	1	45
6AQ7-DIO 1	9	8	0						3	1
6AQ7-DIO 2	9	8	0						3	3

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6AR5	9	3	41		H	4	S	1-5-6	1	156
6AS5	9	3	43	5	H	4	S	2-6-7	1	267
6AU5	9	2	44		H	7	S	1-5-8	1	158
6AU6	9	3	45		H	4	S	1-2-5-6	1	1256
6AV5	9	2	44		H	7	S	1-5-8	1	158
6AV6-TRI	9	3	43		H	4	S	1-5-6-7	1	17
6AV6-DIO 1	9	3	0						3	6
6AV6-DIO 2	9	3	0						3	5
6AW6	9	3	45		H	4	S	1-5-6-7	1	1567
6AX4-DIO	9	7	25		H	8	S	5	3	5
6AX5-P1	9	2	42		H	7	S	3-5	1	5
6AX5-P2	9	2	42						1	3
6BA7	9	4	45		H	5	S	C-1-2-7	1	C127
6BC5	9	3	45		H	4	S	1-5-6	1	156
6BC7-DIO 1	9	4	26	3	H	5	S	2-6-8	3	8
6BC7-DIO 2	9	4	26	3					3	6
6BC7-DIO 3	9	4	26	3					3	2
6BD5	9	2	44		H	7	S	1-5-8	1	158
6BD6	9	4	42		H	3	S	1-2-5-6	1	1256
6BE7	9	4	35		H	5	S	C-1-2-6-7	2	C1267
6BF5	9	3	45	7	H	4	S	1-5-6	1	156
6BF6-TRI	9	3	40		H	4	S	1-5-6-7	1	17
6BF6-DIO 1	9	3	7						3	6
6BF6-DIO 2	9	3	7						3	5
6BH6	9	3	46		H	4	S	1-5-6-7	1	1567
6BJ6	9	3	45		H	4	S	1-5-6-7	1	1567
6BK6-TRI	9	3	33		H	4	S	1-5-6-7	2	17
6BK6-DIO 1	9	3	10						3	6
6BK6-DIO 2	9	3	10						3	5
6BK7-TRI 1	9	4	45		H	5	S	1-2-6-7	1	67

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6BK7-TRI 2	9	4	45						1	12
6BL7-TRI 1	9	7	45		H	8	S	1-2-4-5	1	45
6BL7-TRI 2	9	7	45						1	12
6BN6	9	3	23		H	4	S	2-5-6-7	4	2567
6BQ6	9	2	45		H	7	S	C-4-5	1	C45
6BQ7-TRI 1	9	4	45		H	5	S	1-2-6-7	1	67
6BQ7-TRI 2	9	4	45						1	12
6BT6-TRI	9	3	33		H	4	S	1-5-6-7	2	17
6BT6-DIO 1	9	3	5						3	6
6BT6-DIO 2	9	3	5						3	5
6BU6-TRI	9	3	33		H	4	S	1-5-6-7	1	17
6BU6-DIO 1	9	3	5						3	6
6BU6-DIO 2	9	3	5						3	5
6BY5-P1	9	2	42		H	7	S	4-5	1	5
6BY5-P2	9	2	42						1	4
6CB6	9	3	46		H	4	S	1-5-6-7	1	1567
6CD6	9	2	45		H	7	S	C-5-8	1	C58
6L4	9	1	45	45	H	6	S	2-3	1	23
6M5	9	4	45	68	H	5	S	1-2-7	1	127
6M8-PEN	9	2	41		H	7	S	C-3-4-5-6-8	1	C34
6M8-TRI	9	2	34						2	56
6M8-DIO	9	2	0						3	8
6N5-TRI	9	1	26		H	6	S	2-3-4	1	23
6N5-TAR	9	1	0						4	24
6N8-PEN	9	4	44		H	5	S	C-1-2-6-7-8	1	C126
6N8-DIO 1	9	4	0						3	8
6N8-DIO 2	9	4	0						3	7
6Q4	9	4	47	278	H	5	S	C-1	1	C1
6Q6-TRI	9	2	40		H	7	S	C-3-5	1	C3
6Q6-DIO	9	2	0						3	5
6R4	9	4	44		H	5	S	1-8	1	18

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
6R8-TRI	9	4	38		H	5	S	C-1-2-6-8	1	C8
6R8-DIO 1	9	4	25						3	6
6R8-DIO 2	9	4	25						3	2
6R8-DIO 3	9	4	25						3	1
6S4	9	4	44	1378	H	5	S	C-6	1	C6
6T8-TRI	9	4	38		H	5	S	C-1-2-6-8	1	C8
6T8-DIO 1	9	4	20						3	6
6T8-DIO 2	9	4	20						3	2
6T8-DIO 3	9	4	20						3	1
6U4	9	7	46		H	8	S	5	1	5
6U8-TRI	9	4	45		H	5	S	C-1-2-3-6	1	C1
6U8-PEN	9	4	45						1	236
6V4-P1	9	4	38		H	5	S	1-7	1	1
6V4-P2	9	4	38						1	7
6V5	9	7	42		H	8	S	3-4-5	1	345
6V8-TRI	9	4	35		H	5	S	C-1-2-6-7	2	16
6V8-DIO 1	9	4	23						3	C
6V8-DIO 2	9	4	23						3	7
6V8-DIO 3	9	4	23						3	2
6W4	9	7	45		H	8	S	5	1	5
6W5-P1	9	2	44		H	7	S	3-5	1	5
6W5-P2	9	2	44						1	3
6X8-PEN	9	4	40		H	5	S	C-1-2-3-7-8	2	C78
6X8-TRI	9	4	40						2	23
7AB7	9	2	42		H	7	S	1-3-5	1	135
7AD7	9	1	47		H	8	S	2-3-4-5-6	1	2346
7AF7-TRI 1	9	1	41		H	8	S	3-4-5-6	1	34
7AF7-TRI 2	9	1	41						1	56
7AH7	9	1	46		H	8	S	2-3-4-5-6	1	23456
7AJ7	9	1	44		H	8	S	2-3-4-5-6	1	2346

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
7G8/1206-TET 1	9	1	44		H	8	S	2-3-4-5-7	1	357
7G8/1206-TET 2	9	1	44						1	234
7AK7	9	1	43		H	8	S	2-3-4-6	1	2346
7X6-P1	9	1	44		H	8	S	3-6	1	3
7X6-P2	9	1	44						1	6
12A4	11	4	46	37	H	5	S	C-2	1	C2
12AL5-DIO 1	11	3	23		H	4	S	2-6-7	3	7
12AL5-DIO 2	11	3	23						3	2
12AT7-TRI 1	11	4	47	C	H	5	S	1-2-6-7	1	67
12AT7-TRI 2	11	4	47	C					1	12
12AU6	11	3	46		H	4	S	1-2-5-6	1	1256
12AU7-TRI 1	11	4	44	C	H	5	S	1-2-6-7	1	67
12AU7-TRI 2	11	4	44	C					1	12
12AV6-TRI	11	3	43		H	4	S	1-5-6-7	1	17
12AV6-DIO 1	11	3	5						3	6
12AV6-DIO 2	11	3	5						3	5
12AV7-TRI 1	11	4	46	C	H	5	S	1-2-6-7	1	67
12AV7-TRI 2	11	4	46	C					1	12
12AW6	11	3	46		H	4	S	1-5-6-7	1	156
12AX4-DIO	11	7	25		H	8	S	5	3	5
12AX7-TRI 1	11	4	44	C	H	5	S	1-2-6-7	1	67
12AX7-TRI 2	11	4	44	C					1	12
12AY7-TRI 1	11	4	40	C	H	5	S	1-2-6-7	1	67
12AY7-TRI 2	11	4	40	C					1	12
12AZ7-TRI 1	11	4	45	C	H	5	S	1-2-6-7	1	67
12AZ7-TRI 2	11	4	45	C					1	12
12BA7	11	4	45		H	5	S	C-1-2-7	1	C127
12BD6	11	4	42		H	3	S	1-2-5-6	1	1256
12BH7-TRI 1	11	4	45	C	H	5	S	1-2-6-7	1	67

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
12BH7-TRI 2	11	4	45	C					1	12
12BK6-TRI	11	3	33		H	4	S	1-5-6-7	2	17
12BK6-DIO 1	11	3	10						3	6
12BK6-DIO 2	11	3	10						3	5
12BN6	11	3	24		H	4	S	2-5-6-7	4	2567
12BZ7-TRI 1	11	4	40	C	H	5	S	1-2-6-7	2	67
12BZ7-TRI 2	11	4	40	C					2	12
12BT6-TRI	11	3	33		H	4	S	1-5-6-7	2	17
12BT6-DIO 1	11	3	5						3	6
12BT6-DIO 2	11	3	5						3	5
12BU6-TRI	11	3	33		H	4	S	1-5-6-7	1	17
12BU6-DIO 1	11	3	0						3	6
12BU6-DIO 2	11	3	0						3	5
12S8-TRI	11	7	42		H	8	S	C-1-3-4-6	1	C_6
12S8-DIO 1	11	7	5						3	3
12S8-DIO 2	11	7	5						3	4
12S8-DIO 3	11	7	5						3	1
12SY7	11	1	43		H	7	S	1-3-4-5-8	1	13458
14AF7/XXD-TRI 1	11	1	43		H	8	S	3-4-5-6	1	34
14AF7/XXD-TRI 2	11	1	43						1	56
14F8-TRI 1	11	2	42		H	7	S	1-3-6-8	1	13
14F8-TRI 2	11	2	42						1	68
14X7-TRI	11	1	41		H	8	S	2-3-5-6	1	23
14X7-DIO 1	11	1	8						3	5
14X7-DIO 2	11	1	8						3	6
19BG6	12	2	43		H	7	S	C-5-8	1	C58
19C8-TRI	12	4	41		H	5	S	C-1-2-6-8	1	C8
19C8-DIO 1	12	4	25						3	6
19C8-DIO 2	12	4	25						3	2
19C8-DIO 3	12	4	25						3	1

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
19J6-TRI 1	12	3	45		H	4	S	1-2-5-6	1	25
19J6-TRI 2	12	3	45						1	16
19T8-TRI	12	4	38		H	5	S	C-1-2-6-8	1	C8
19T8-DIO 1	12	4	20						3	6
19T8-DIO 2	12	4	20						3	2
19T8-DIO 3	12	4	20						3	1
19V8-TRI	12	4	35		H	5	S	C-1-2-6-7	2	16
19V8-DIO 1	12	4	23						3	C
19V8-DIO 2	12	4	23						3	7
19V8-D103	12	4	23						3	2
25AV5	13	2	45		H	7	S	1-5-8	1	158
25BQ6	13	2	45		H	7	S	C-4-5	1	C45
25W4	13	7	43		H	8	S	5	1	5
26A6	13	3	46		H	4	S	1-2-5-6	1	1256
26C6-TRI	13	3	40		H	4	S	1-5-6-7	1	17
26C6-DIO 1	13	3	0						3	5
26C6-DIO 2	13	3	0						3	6
26D6	13	3	45		H	4	S	1-5-6-7	1	1567
26BK6-TRI	13	3	34		H	4	S	1-5-6-7	2	17
26BK6-DIO 1	13	3	10						3	6
26BK6-DIO 2	13	3	10						3	5
26Z5W-DIO 1	13	4	25	C	H	5	S	1-6	3	6
26Z5W-DIO 2	13	4	25	C					3	1
35B5	14	3	45	7	H	4	S	1-5-6	1	156
35C5	14	3	44	5	H	4	S	2-6-7	1	267
50C5	16	3	45	5	H	4	S	2-6-7	1	267
50X6-P 1	16	1	44		H	8	S	3-6	1	3
50X6-P 2	16	1	44						1	6
50Y7-P 1	16	2	44	6	H	7	S	3-5	1	5
50Y7-P 2	16	2	44						1	3

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
502A	9	2	46		H	7	S	3-5-6	1	356
717A	9	2	37		H	7	S	4-6-8	1	468
807	9	1	43		H	5	S	C-2-3	1	C23
879/2X2	6	1	32				S	C	4	C
1203A	9	1	15		H	8	S	4	3	4
1204	9	2	42		H	7	S	1-3-5	1	135
1206-TET 1	9	1	43		H	8	S	2-3-4-5-7	1	357
1206-TET 2	9	1	43						1	234
1229	5	1	29				S	C-2-3	2	C23
1232	9	1	46		H	8	S	2-3-4-6	1	2346
1267	2	2	35				S	5-7	4	5
1273	9	1	43		H	8	S	2-3-4-6	1	2346
1280	11	1	43		H	8	S	2-3-4-6	1	2346
1293	4	1	32	5			S	2-6	2	26
1614	9	2	42		H	7	S	3-4-5	1	345
1619	6	2	42				S	3-4-5-8	1	3458
1624	6	1	42				S	C-2-3	1	C23
1625	11	1	44		H	7	S	C-3-4	1	C34
1626	11	2	40		H	7	S	3-5	1	35
1629-TRI	11	2	35		H	7	S	3-4-5	1	35
1629-TAR	11	2	0						4	34
1641/RK60-P 1	8	1	41				S	C-C	1	C
1641/RK60-P 2	8	1	41						1	C
1641/RK60	For inter-element leakage and quality test connect lead to each top cap in succession.									
5516	9	2	44	146	H	7	S	C-3-5	1	C35
5517		3	29	267			S	C-4	4	C4
5608A-TRI 1	6	1	41		H	7	S	2-3-5-6	1	56
5608A-TRI 2	6	1	41						1	23
5610	9	3	41	5	H	4	S	1-6	1	16
5618	9	1	46		S		S	2-3-4-6	1	2346

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
5642	3	1	0				S	C	3	C
5642	Insert filament leads into outside pin connections (#1 and #7) of 7 pin sub-miniature adapter.									
5642	Test on diode scale.									
5651	17	2	10	34567			S	1	2	1
5654	9	3	37		H	4	S	1-5-6	2	156
5662	9	3	43	6	H	4	S	1-7	4	7
5663	9	3	43	6	H	4	S	1-5-7	4	7
5670-TRI 1	9	1	36	5	H	C	S	3-4-6-7	2	67
5670-TRI 2	9	1	36	5					2	34
5679-DIO 1	9	1	15	4	H	8	S	3-6	3	6
5679-DIO 2	9	1	15	4					3	3
5687-TRI 1	11	4	46	8	H	5	S	C-1-2-7	1	C7
5687-TRI 2	11	4	46	8					1	12
5691-TRI 1	9	7	39		H	8	S	1-2-4-5	1	45
5691-TRI 2	9	7	39						1	12
5692-TRI 1	9	7	41		H	8	S	1-2-4-5	1	45
5692-TRI 2	9	7	41						1	12
5693	9	3	43		H	7	S	3-4-6-8	1	3468
5696	9	3	45	7	H	4	S	1-5-6	4	6
5722	8	3	20	67			S	1	1	1
5731	9	1	37		H	6	S	3-4	1	34
5749	9	3	44		H	4	S	1-2-5-6	1	1256
5751-TRI 1	11	4	42	C	H	5	S	1-2-6-7	1	67
5751-TRI 2	11	4	42	C					1	12
5763	9	4	45	C	H	5	S	1-3-6-8	1	1368
5812	9	3	43	7			S	1-2-5-6	1	1256
5814-TRI 1	11	4	42	C	H	5	S	1-2-6-7	1	67
5814-TRI 2	11	4	42	C					1	12
5824	13	2	44		H	7	S	3-4-5	1	345
5879	9	4	33		H	5	S	C-1-7-8	2	C178

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
5881	9	2	43		H	7	S	3-4-5	1	345
5910	4	1	32	5			S	2-3-6	2	236
CK1013		3	29	267			S	C-4	4	C4
CK5608-TRI 1	6	1	40		H	7	S	2-3-5-6	1	56
CK5608-TRI 2	6	1	40						1	23
CK5654	9	3	37		H	4	S	1-5-6	2	156
CK5656-TET 1	9	4	46		H	5	S	1-2-3-7-8	1	137
CK5656-TET 2	9	4	46						1	128
CK5672	4	5	0				S	4-6-7	3	467
CK5677	3	4	0				S	5-7	3	57
CK5678	3	3	0				S	4-6-7	3	467
CK5686	9	4	41	C	H	5	S	2-6-7	1	267
CK5694-TRI 1	9	2	41		H	7	S	3-4-5-6	1	56
CK5694-TRI 2	9	2	41						1	34
CK5702	9	4	44		H	5	S	1-3-6-7	1	1367
CK5703	9	4	0		H	5	S	3-7	3	37
CK5725	9	3	44		H	4	S	1-5-6-7	1	1567
CK5726-P 1	9	3	44		H	4	S	2-7	1	7
CK5726-P 2	9	3	44						1	2
CK5744	9	5	43		H	6	S	4-7	1	47
CK502AX	3	5	0				S	4-6-7	3	467
CK503AX	3	5	10				S	4-6-7	3	467
CK506AX	3	5	30				S	4-6-7	2	467
CK523AX	3	5	10				S	4-6-7	3	467
CK568AX	3	4	0				S	5-7	3	57
CK569AX	3	3	0				S	4-6-7	3	467
CK551AXA-PEN	3	2	0				S	3-5-6-7	3	367
CK551AXA-DIO	3	2	0						3	5
CK606BX	9	5	6		H	6	S	7	3	7
CK605CX	9	4	44		H	5	S	1-3-6-7	1	1367

Form 3947

Tube Type	Fil. Sel.	Fil. Ret.	Tube Sel.	Tog. Down	Leakage or Short Test				Quality Test	
					Cath-Htr.		Inter-Element			
					Cir. Sel.	Tog. Up	Cir. Sel.	Toggles Up (Separately)	Cir. Sel.	Toggles Up (Together)
CK608CX	9	4	0		H	5	S	3-7	3	37
G84	6	1	30				S	2	1	2
FM1000	9	1	45		H	8	S	2-4-5-6-7	1	24567
LA	9	1	40				S	2-3-4	1	234
XXB-TRI 1	7	1	36	7			S	3-4-5-6	2	56
XXB-TRI 2	7	1	36	7					2	34

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#2156
22½V B Battery

NOTES

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Tel. 201/753-4600

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Tel. 315/737-7328

★★★NEW YORK, CLARENCE 14031
☐ TROTT ELECTRONICS INC.
9020 Wehrle Drive
Tel. 716/634-8500

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BROWNELL-ELECTRO INC.
85 Tenth Avenue
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☐ NILSSON ELECTRICAL LABORATORY, INC.
111 8th Avenue — Rm. 1525
Tel. 212/675-7944

★★★NEW YORK, ROCHESTER
☐ ELECTRONIC INSTRUMENT COMPANY
325 Mt. Read Blvd.
Tel. 716/328-4350

★★★NORTH CAROLINA, CHARLOTTE 28216
☐ BROWNELL-ELECTRO INC.
5141 Belhaven Blvd.
Box #16368
Tel. 704/394-4341

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NOTE

This Operator's Manual contains information essential to the operation of this Instrument. Therefore, it should be kept with the Instrument at all times and not misplaced or discarded.

AUTHORIZED SERVICE CENTERS

SIMPSON ELECTRIC COMPANY

853 Dundee Avenue, Elgin, Illinois 60120 — Phone: (312) 697-2260

★ Parts Sales & Repair Service Only
★★ Parts, General Test Equipment & Panel Instrument Sales & Service
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YUKON RADIO SUPPLY, INC.
3222 Commercial Drive
P.O. Box 406
Tel. 907/277-1497

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R. M. ZOOK & ASSOCIATES
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Tel. 907/272-6917

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Tel. 213/685-7020

★★★CALIFORNIA, GLENDALE 91201
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Tel. 213/246-4861

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INSTRUMENT LAB
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307 27th St., Box 8945
Tel. 305/843-6775

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TAMPA INSTRUMENTATION CENTER
A.C. FERNANDEZ ELECTRIC
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Tel. 813/870-0183

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Tel. 404/762-5181

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EMC CORPORATION
2979 Ualena Street
Tel. 808/847-1138

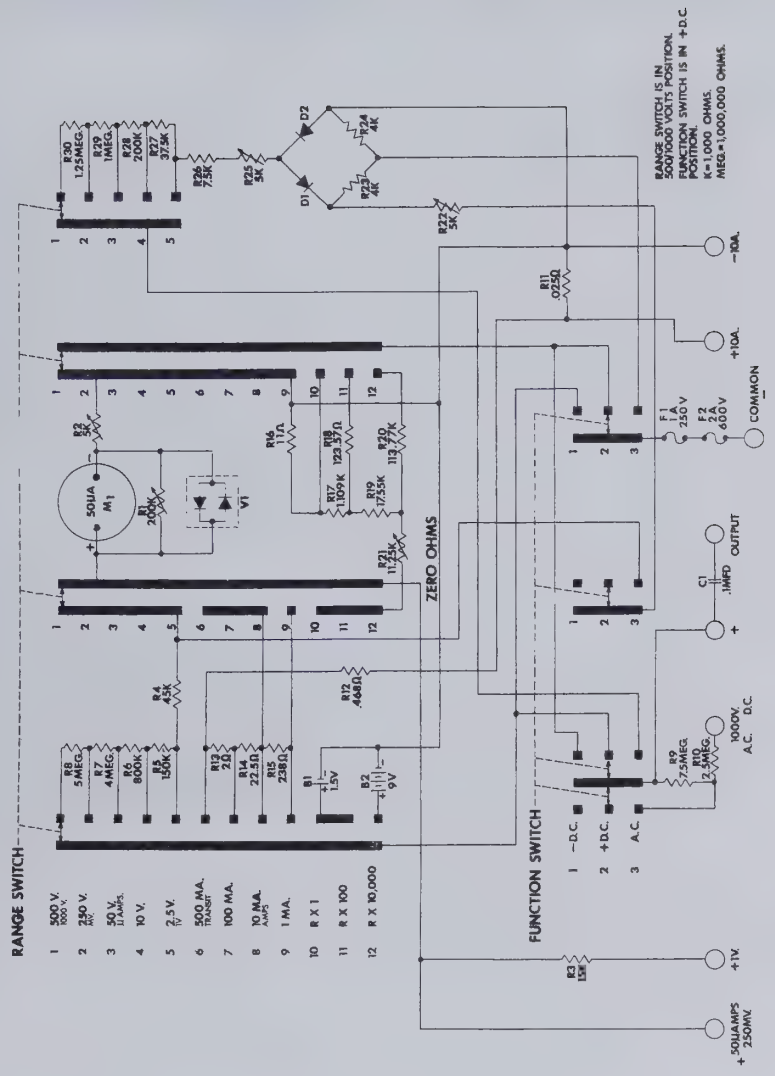


Figure 6-1. Schematic Diagram

SAFETY SYMBOLS

This marking adjacent to another marking or a terminal or operating device indicates that the Operator must refer to an explanation in the Operating Instructions to avoid damage to the equipment and/or to avoid personal injury.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the Instrument.

WARNING

These Instruments are designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely prior to making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson Model 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with the 260-6 1mA range and use this as the measuring instrument.

R30	Resistor, 1.25 MΩ	5-115068
C1	Capacitor, 0.1 μF, 400V	1-113733
D1	Diode, Germanium	1-115970
D2	Diode, Germanium	1-115970
V1	Varistor, Silicon	1-110670
F1	Fuse, 1 Amp, 250V; 3AG (1¼" x ¼") Quick acting (Littelfuse Type 312001)	1-112507
F2	Fuse, 2 Amp, 600V (Bussman Type BBS or KTK)	5-119056
F1	Knobs: For Function Switch	1-115789
	Knobs: For Zero Ohms Adjust	1-115790
	Knobs: For Range Switch (less Set Screw)	3-260180
	Knobs: Set Screw (for Knob 3-260180)	1-114178
	Case Assembly, Phenolic, Complete, (including handle less Battery Compartment Cover)	10-861725
	Battery Compartment Cover Assembly	10-861724
	Rubber Bumper Plug	5-115039
	260-6, 260-6RT Indicating Instrument with Panel Assembly	D13721
	260-6M, 260-6MRT Indicating Instrument with Panel Assembly	D13722
	Cover Assembly for Indicating Instrument	0-005674
	Probe Tip Leads, one red and one black	00125
	Label, UL Listing	6-110977
	Label, Operator Servicing	6-110960
	Label, Battery and Fuse Data	6-110959
	Label, Terminal Rating	6-110979
	Label, Warning	6-111474

R3	Resistor, 15 kΩ	5-110756
R4	Resistor, 45 kΩ	1-114192
R5	Resistor, 150 kΩ	1-113366
R6	Resistor, 800 kΩ	1-113363
R7	Resistor, 4 MΩ	1-113362
R8	Resistor, 5 MΩ	5-110454
R9	Resistor, 7.5 MΩ	5-111668
R10	Resistor, 2.5 MΩ	5-111669
R11	Resistor, 0.025Ω Shunt, 10A (Calibrate in VOM)	3-811793
R12	Resistor, 0.468Ω (Bobbin)	10-675254
R13	Resistor, 2Ω (Bobbin)	10-805077
R14	Resistor, 22.5Ω (Bobbin)	10-805076
R15	Resistor, 238Ω	1-115897
R16	Resistor, 11Ω, 5W (Wire Wound)	5-119567
R17	Resistor, 1.109 kΩ	5-112938
R18	Resistor, 123.5Ω	5-112939
R19	Resistor, 17.55 kΩ	5-113020
R20	Resistor, 113.7 kΩ	5-112941
R21	Potentiometer, 11.25 kΩ	5-115263
R22	Rheostat, 5 kΩ	1-116254
R23	Resistor, 4 kΩ	5-114835
R24	Resistor, 4 kΩ	5-114835
R25	Rheostat, 5 kΩ	1-116254
R26	Resistor, 7.5 kΩ	1-113370
R27	Resistor, 37.5 kΩ	1-113393
R28	Resistor, 200 kΩ	1-113365
R29	Resistor, 1 MΩ	1-113392

Figure 1-1. Simpson 260-6 Volt-Ohm-Milliammeter

Figure 1-2. Simpson 260-6M Volt-Ohm-Milliammeter

SECTION VI

SERVICING INSTRUCTIONS

6.1 GENERAL

NOTE

This instrument must be serviced by qualified personnel. To aid in troubleshooting a schematic diagram is enclosed. The replacement parts list (Table 6-1) describes the components and refers to Simpson part numbers. Reference Symbol numbers correlate the components shown on the schematic diagram with the parts list.

6.1.1 The following information is provided as an adjunct to the overall text contained in this manual and should be read and understood thoroughly prior to ordering replacement parts for the Instrument.

6.2 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

6.2.1 To obtain replacement parts, address order to the nearest Authorized Service Center (listed on the last pages of this manual). Refer to paragraph 2.3.1 for ordering instructions.

Table 6-1. Replacement Parts

Reference Symbol	Description	Part No.
R1	Rheostat, 200 kΩ	1-110193
R2	Rheostat, 5 kΩ	5-114099

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

SECTION I
INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson Volt-Ohm-Milliammeters 260 Series 6 and Series 6M (hereafter referred to as the 260 or as the Instrument), are identical instruments electrically and mechanically, except that the Series 6M is equipped with a mirrored dial to eliminate parallax (Figures 1-1 and 1-2). The 260 Series 6 is a rugged, accurate, compact, easy-to-use instrument. The Instrument can be used to make accurate measurements of DC and AC voltage, direct current, resistance, decibels, and output voltage. The output voltage function is used for measuring the AC component of a mixture of AC and DC voltage. This function occurs primarily in amplifier circuits.

1.1.2 The 260 Series 6 has the following new features: a 0-1 volt DC range, 0-500 volt DC and AC ranges, a TRANSIT position on the range switch, rubber plug bumpers on the bottom of the case to reduce sliding, improved test leads and an externally accessible battery and fuse compartment. Batteries and one amp fuse can be changed quickly by loosening the single screw of the compartment cover located on the bottom of the case.

1.1.3 To complement the circuit accuracy, the 260 features a new taut-band, annular movement. The annular movement provides self-shielding, and the taut-band suspension provides a high degree of repeatability and is highly resistant to damage by shock or vibration.

1.1.4 Several internally located calibration circuits are provided to increase the initial accuracy of the 260 and to facilitate recalibration should it become necessary.

1.1.5 The 260 uses the most modern components and circuit techniques. It is assembled by well-trained personnel using quality

materials and modern equipment. This combination of design, materials, and skillful assembly results in a unit that will take considerable abuse and still provide accurate indication. If it is kept clean and is not unduly abused or misused, or subjected to extreme shock or vibration, the 260 will give many years of trouble-free service.

1.2 DESCRIPTION

1.2.1 Phenolic Case

1.2.2 The phenolic case is designed with heavy reinforced walls for maximum durability and provides excellent protection for the circuit components. The case has an externally accessible battery and fuse compartment. Access to the batteries and one amp fuse is obtained by unscrewing a single captivated screw at the bottom of the case and sliding out the compartment cover. (A spare fuse is also provided in the compartment.) Rubber plug bumpers on the bottom of the case reduce sliding should the Instrument be accidentally pulled by the test leads when it is on a workbench.

1.2.3 Printed Circuit

1.2.4 Most of the component parts are mounted on a printed circuit board which simplifies assembly and maintenance, thus extending the useful life of the Instrument.

1.2.5 Test Leads

1.2.6 Each Instrument is furnished with one pair of (Cat. No. 00125) test leads 4 feet long. One lead is black and the other red for easy polarity identification. The test lead wire consists of a large number of fine strands and is very flexible. The insulation of the wire is more than adequate for the highest voltage that the Instrument will measure. The red and black test leads have probe tips which are threaded near the base. The alligator clips may be screwed on or off either test lead to provide a probe or a clip for the operator's convenience (Table 1-2).

WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT MEASURING TERMINALS BEFORE OPENING COVERS.
WARNING
OPERATOR'S MANUAL
SIMPSON ELECTRIC COMPANY
ELGIN, ILLINOIS 60120

Figure 5-1. Battery and Fuse Compartment.

5.4 REMOVING THE INSTRUMENT CASE

5.4.1 To gain access to the inside of the Instrument panel, for replacing the fuse, first: de-energize and disconnect the test leads, and remove the cover from the battery compartment, then remove the four case-fastening screws. Second: after removing the screws, lift the case from the panel.

NOTE: When replacing the case, make certain that the wires leading to the battery compartment are seated in their respective slots within the compartment wall. This will prevent damage to the wire insulation during mating of panel and case.

5.5 TEST LEAD INSPECTION

5.5.1 Periodic inspection of the test leads is recommended to detect cuts, burned areas, deterioration or other damage that could reduce the insulation strength of the leads.

NOTE: Before returning the Instrument to service, check the performance ratings and make sure that the electrical and mechanical configurations have been restored to their original applications.

1.2.7 Fuse Protection

1.2.8 A 1-ampere 250-volt and a 2-ampere 600-volt high capacity fuse (1000A) are provided to protect the 260 low impedance circuits from misuse on the Ohm and Current ranges. The 1-ampere fuse is used for normal overload conditions, and the 2-ampere fuse is connected in series with the 1-ampere fuse as a protection against excessive high energy overloads applied to current or ohms ranges.

1.2.9 For maximum protection it is important to replace the 1A fuse with a Littelfuse type 312001 only. This will allow the combination of 1A and 2A BBS/KTK fuse to give maximum protection to the unit and the user under overload conditions which may occur within the measuring capability of the VOM.

1.2.10 If the instrument fails to indicate, the 1 Amp or the 2 Amp fuses may be burned out. (Refer to Paragraph 5.3 for fuse replacement.) A 1 Amp spare fuse is furnished with each Instrument. Both 1 Amp fuses are located in the battery and fuse compartment. The 2 Amp fuse is located on the instrument panel under the printed circuit board.

1.2.11 Movement Overload Protection

1.2.12 In addition to the fuse, a varistor protects the indicating Instrument circuit. The varistor limits the current through the moving coil in case of overload.

CAUTION

The fuses and varistor will prevent serious damage to the 260 in most cases of accidental overload. However, no fuse protection system is completely foolproof;therefore, any misapplication on high voltage circuits can still damage the Instrument. Also, care should always be exercised to set the switches and connect the leads properly and to avoid overload conditions.

1.3 TECHNICAL DATA

1.3.1 Table 1-1 lists the technical data for the 260-6 and 6M (RT).

Table 1-1. Technical Data

1.	DC VOLTS:	
	Ranges:	0-1-2.5-10-50-250-500-1000V
	Sensitivity:	20,000 ohms per volt
2.	DC MILLIVOLTS:	
	Range:	0-250mV
	Sensitivity:	20,000 ohms per volt
3.	AC VOLTS:	
	Ranges:	0-2.5-10-50-250-500-1000V
	Sensitivity:	5,000 ohms per volt
4.	OUTPUT VOLTAGE (AC):	
	Ranges:	0-2.5-10-50-250 (limited to 350 VDC)
5.	DC MICROAMPERES:	
	Range:	0-50μA
	Voltage Drop:	250 mV
6.	DC MILLIAMPERES:	
	Ranges:	0-1-10-100 -500 mA
	Voltage Drop (Approx.):	250 mV, 250 mV, 280 mV, 400 mV
7.	DC AMPERES:	
	Range:	0-10A
	Voltage Drop (Approx.)	250 mV

d. Observe polarity when replacing the 1.5-volt D cell and connect as indicated. The D cell is held in place with spring clips which also act as battery contact clips. The 9-volt battery contacts and connector are polarized. To remove the 9-volt battery, first withdraw battery with mated connector from the compartment. Then remove the connector.

5.3 FUSE REPLACEMENT

5.3.1 One-Ampere Fuse:

5.3.2 The 1-ampere fuse (also the spare) is located in the externally accessible battery and fuse compartment. Access to the compartment is obtained by de-energizing and disconnecting the test leads and loosening the single captivated screw on the compartment cover. To replace a burned out fuse, remove the 9-volt battery, then replace the fuse.

5.3.3 Two-Ampere Fuse:

5.3.4 The 2-ampere fuse is located within the instrument panel under the printed circuit board. (To gain access to the fuse, see paragraph 5.4.)

NOTE: It is important to replace the 1 and 2 ampere fuse with the specified fuse type only. (See paragraph 1.2.9 and replacement parts list, Table 6-1, for proper fuse type.)

SECTION V

OPERATOR SERVICING

5.1 GENERAL

5.1.1 The following paragraphs of this section describe the battery replacement, fuse replacement, removing the instrument case, and test lead inspection and procedures for the Simpson 260.

5.2 BATTERY REPLACEMENT

a. Two batteries are used inside the case to supply power for resistance measurements. One is a 1.5-volt D cell and the other is a 9-volt battery. When it is no longer possible to adjust the pointer to zero for the R × 1 and R × 100 ranges (refer to ZERO OHMS ADJUSTMENT paragraph 4.16) replace the 1.5-volt cell. When it is no longer possible to adjust the pointer to zero on the R × 10,000 range, replace the 9-volt battery.

b. Recommended replacement batteries are:
1.5-volt D cell, NEDA 13F (Burgess No. 2:Eveready No. 950).
9-volt battery, NEDA 1604 (Burgess 2U6 or Eveready 216).

c. To install or replace a battery, de-energize and disconnect test leads from the Instrument, then remove the cover to the externally accessible battery compartment by loosening the single captivated screw.

NOTE: Batteries should be replaced before their useful life has expired. Failure to do so may result in corrosion and battery leakage.

8. RESISTANCE:

	R × 1	R × 100	R × 10,000
Range	0-2,000Ω	0-200,000Ω	0-20 MΩ
Center Reading	12Ω	1200Ω	120,000Ω
Nominal Open Circuit Voltage	1.5V	1.5V	9V
Nominal Short Circuit Current	125 mA	1.25 mA	75μA

9. *ACCURACY:

DC Voltage Ranges: 2% of Full Scale
DC Current
0-50 μA Range: 1.5% of Full Scale
Other Ranges: 2% of Full Scale
**AC Voltage Ranges: 3% of Full Scale
Frequency Response: Referenced to 100 Hz (Figures 4-2 and 4-4)

Resistance Ranges:
R×1: 2.5° of Arc
R×100: 2° of Arc
R×10,000 2° of Arc

10. DECIBELS:
Range: —20 to +10 dB, —8 to +22dB, +6 to +36 dB, +20 to +50 dB
Reference Level: With zero dB power level equal to 1 mW across a 600Ω line.

11. BATTERIES:
Voltage: 1.5V, 9V
NEDA No.: 13F, 1604

12. FUSE: F1 1A, 250V, type 3AG, quick-acting Littelfuse Type 312001, F2 2A, 600V, Type BBS or KTK (Bussman)

13.	TEST LEADS:	1 red, 1 black, 48" long.
14.	SIZE:	5½" x 7" x 3⅛" (13.34 x 17.78 x 7.94 mm)
15.	WEIGHT:	3 lbs. (1.359 kg)
16.	***RATED-CIRCUIT TO-GROUND VOLTAGE:	1000V AC/DC (1500V Peak) Max.

** Accuracies specified are for the 260 in a horizontal position.*

*** Responds to the average value of an AC current, and is calibrated to indicate the rms value of a pure sine wave.*

****Per ANSI C39.5 April 1974: "The maximum voltage, with respect to ground, which may safely and continuously be applied to the circuit of an Instrument."*

1.4 ITEMS AND ACCESSORIES

1.4.1 All items and accessories required for the operation of the 260 are furnished with each instrument, and listed in Table 1-2. (Available replacement parts are listed in Table **6-1**.)

1.5 DEFINITION OF ACCURACY

1.5.1 The voltage and current accuracy of this instrument is commonly expressed as a percent of full scale. This should not be confused with accuracy of reading (indication). For example, +2% of full scale on the 10 volt range allows an error of ±0.20V at any point on the dial. This means that at full scale, the accuracy of reading would be ±2%, but at half scale it would be ±4%. Therefore, it is advantageous to select a range which gives an indication as near as possible to full scale.

NOTE: The resistance of diodes will measure differently from one resistance range to another on the same VOM with the function switch in a given position. For example, a diode which measures 80 ohms on the R × 1 range may measure 300 ohms on the R × 100 range. The difference in values is a result of the diode characteristics and is not indicative of any fault in the VOM.

4.18.1 If there is a "forward" and "backward" resistance such as in diodes, the resistance should be relatively low in one direction (for forward polarity) and higher in the opposite direction. Rotate the function switch between the two DC positions to reverse polarity. This will determine if there is a difference between the resistance in the two directions. To check a semiconductor in or out of a circuit (forward and reverse bias resistance measurements), consider the following *before* making the measurement:

a. The polarity of the internal ohmmeter battery voltage at the (+) pos jack is identical to the function switch, polarity setting, and opposite to the (—) common jack.

b. Ensure that the range selected will not damage the semiconductor. (Refer to Table 1-1 in Section I, and review the specification limits of the semiconductor according to the manufacturer's ratings.)

c. If the semiconductor is a silicon diode or conventional silicon transistor, no precautions are normally required.

d. If the semiconductor material is germanium, check the ratings of the device and refer to Table 1-1, item 8, Section I.

1.6 SAFETY CONSIDERATIONS

1.6.1 This Operator's Manual contains cautions and warnings alerting the user to hazardous operating and service conditions. This information is flagged by CAUTION or WARNING headings throughout this publication, where applicable, and is defined at the front of the manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating conditions of the Instrument, these instructions must be adhered to.

Table 1-2. Items and Accessories Furnished With This Instrument

Quantity	Description	Number
1	Test Lead Set-One red and one black (4 ft. long) each with combination probe tip and removable rubber-sleeved alligator clip at one end and banana plug on opposite end.	00125
*1	1.5 volt, D Cell, NEDA 13F	
*1	9.0 volt Cell, NEDA 1604	
1	1 Amp, 250V Fuse, Littelfuse Type #312001	
1	2 Amp, 600V Fuse, Bussman Type BBS or KTK	
1	Operator's Manual	6-110928

**Batteries are standard items replaceable from local retail stores.*

Table 1-3 Additional Accessories

Description	Number
Ever-Redy Carrying Case	00805
Roll-Top Safety Carrying Case	00248
Vinyl Carrying Case	01818
Deluxe Carrying Case	00812

SECTION II
INSTALLATION

2.1 GENERAL

2.1.1 This section contains information and instructions for the installation and shipping of the Simpson 260. Included are unpacking and inspection procedures, warranty, shipping, power source requirements, operating position and care.

2.2 UNPACKING AND INSPECTION

2.2.1 Examine the shipping carton for obvious signs of damage. Inspect the Instrument for possible damage incurred during shipment. If damage is noted, notify the carrier and supplier and do not attempt further use of the Instrument. If Instrument appears to be in good condition, read Operator's Manual in its entirety. Become familiar with the Instrument as instructed in the manual, then proceed to check the electrical performance as soon as possible. Also, check that all items are included with the Instrument (Table 1-2).

2.2.2. After unpacking the Instrument, you will find a 1.5V battery and a 9V battery in separate envelopes in the box with the Instrument and test leads. Two alligator clips for the test leads are in a polyethylene bag. (See Section V for instructions on how to open the battery compartment and install the batteries.)

2.3 WARRANTY

2.3.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

charged. Disconnect shunted component from the circuit before measuring its resistance.

b. Set the range switch to one of the resistance range positions as follows (Figure 4-8):

1. Use R × 1 for resistance readings from 0 to 200 ohms.
2. Use R × 100 for resistance readings from 200 to 20,000 ohms.
3. Use R × 10,000 for resistance readings above 20,000 ohms.

c. Set the function switch at either -DC or +DC position:

Operation is the same in either position except if there are semiconductors in the circuit. (See Paragraph 4.2.1) Adjust ZERO OHMS control for each resistance range.

d. Observe the reading on the OHMS scale at the top of the dial. *Note: the OHMS scale reads from right to left for increasing values of resistance.*

e. To determine the actual resistance value, multiply the reading by the factor at the switch position. (K on the OHMS scale equals one thousand.)

4.18 RESISTANCE MEASUREMENT OF SEMICONDUCTORS

CAUTION

Make sure that the OHMS range being used will not damage any of the semiconductors (refer to Table 1-1, item 8, Section I).

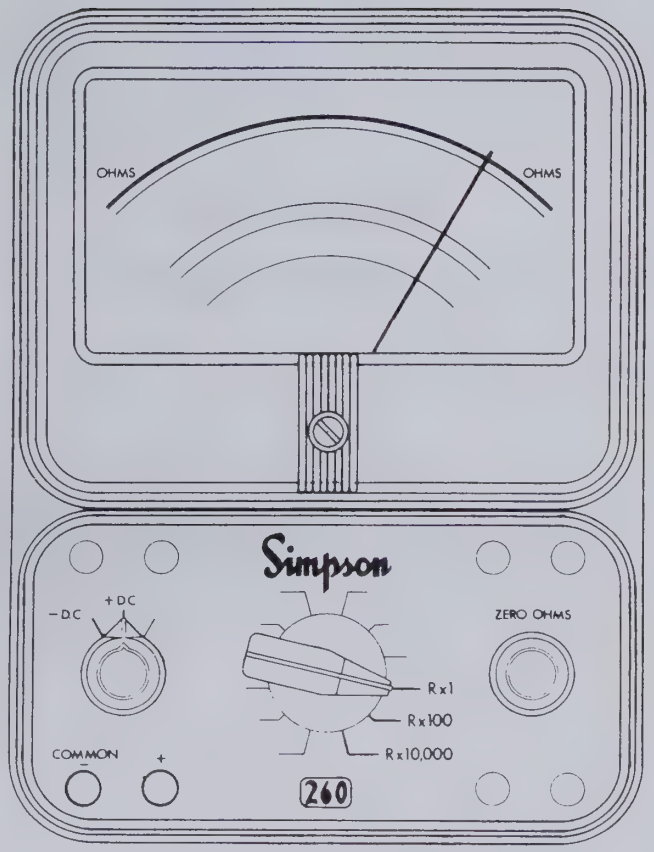


Figure 4-8. Jacks and Switch Positions for Measuring Resistance

NOTE: For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center for instructions (listed on the last pages of this manual). If it's necessary to contact the factory directly, give full details of any difficulty and include the Instrument model number, series number, and date of purchase. Service data or shipping instructions will be mailed promptly. If an estimate of charges for non-warranty or other service work is required, a maximum charge estimate will be quoted. This charge will not be exceeded without prior approval.

2.4 SHIPPING

2.4.1 Pack the Instrument carefully and ship it prepaid to the proper destination. Insure the Instrument.

2.5 POWER SOURCE REQUIREMENTS

2.5.1 There are two batteries in the ohmmeter circuits. One is a NEDA 13F D size cell that furnishes 1.5 volts for the R $\times$ 1 and R $\times$ 100 ranges. A NEDA 1604 battery furnishes 9 volts for the R $\times$ 10,000 range. The 1.5 D cell is held in place with two spring clips which also serve as battery contacts. The 9-volt battery is held in place with a spring clip but contact is made with

a separate connector that is polarized. (Always observe correct polarity when replacing the 1.5-volt D cell.)

2.6 OPERATING POSITION

2.6.1 A handle is attached to the side of the instrument case. The handle may be used to support the Instrument in a convenient, sloping position for easy viewing. The VOM case can also be placed either in a vertical or horizontal position. The horizontal position is preferable for greater accuracy since the Instrument is calibrated in this position.

2.7 CARE

2.7.1 Immediately clean all spilled materials from the Instrument and wipe dry. If the spillage is corrosive, use a suitable cleaner to neutralize the corrosive action, and remove the spillage.

2.7.2 Whenever the Instrument is not in use, rotate the range switch to the TRANSIT position.

2.7.3 Whenever possible, avoid prolonged exposure or usage in areas which are subject to temperature and humidity extremes, vibration or mechanical shock, dust or corrosive fumes, or strong electrical or electromagnetic interferences.

2.7.4 Monthly Care: Verify Instrument accuracy by performing

4.16 RESISTANCE MEASUREMENTS

4.16.1 When resistance is measured, VOM batteries B1 and B2 furnish power for the circuit. Since batteries are subject to variation in voltage and internal resistance, the Instrument must be adjusted to zero before measuring a resistance, as follows:

a. Turn range switch to desired ohms range.

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Connect ends of test leads together to short the VOM resistance circuit.

d. Rotate the ZERO OHMS control until pointer indicates zero ohms. If pointer cannot be adjusted to zero, one or both of the batteries must be replaced. (For battery replacement, refer to Section V.)

e. Disconnect shorted ends of test leads.

4.17 MEASURING RESISTANCE

a. Before measuring resistance in the circuit make sure the power is off to the circuit being tested and all capacitors are dis-

4.14 DIRECT CURRENT MEASUREMENT 0-10A RANGE

a. Plug the black test lead into the -10A jack and the red test lead into the +10A jack.

b. Set the range switch at 10 AMPS (dual position with 10mA).

c. Open the ground side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

NOTE: The function switch has no effect on polarity for the 10 AMPS range.

d. Turn the power on. Read the current directly on the black DC scale. Use the 0-10 figures to read directly in amperes.

e. Turn the power off and disconnect the test leads.

CAUTION

When using the 10 ampere range, never remove a test lead from its panel jack while the current is flowing through the circuit. Otherwise, injury to the user and damage to the instrument may occur.

4.15 TRANSIT POSITION

4.15.1 The 500 mA range switch position is also the TRANSIT position. The additional damping of the movement in the TRANSIT position will reduce pointer swing when the 260 is carried.

operational checks using known, accurate, stable sources. If proper calibration equipment is not available, contact your nearest Simpson Authorized Service Center (refer to last pages of this manual). If the Instrument has not been used for 30 days, check the batteries for leakage and replace if necessary.

2.7.5 Annual Care: It is recommended that the Instrument be returned annually to your nearest Simpson Authorized Service Center, or to the factory, for an overall check, adjustment, and calibration.

2.7.6 Storage: When the Instrument is not in use, store it in a room free from temperature extremes, dust, corrosive fumes, and mechanical vibration or shock. If storage time is expected to exceed 30 days, remove batteries.

SECTION III

CONTROLS, JACKS, AND INDICATORS

3.1 GENERAL

3.1.2 All operating and adjustment controls, jacks and indicators for the Simpson 260 are described in this section along with a list (Table 3-1) describing their function. Become familiar with each item prior to operating the Instrument.

3.2 FRONT PANEL DESCRIPTION

3.2.1 Description of front panel controls, jacks, and indicators is as follows:

NOTE: The item call-out in Figure 3-1 corresponds with the numerical order of the items listed in Table 3-1.

Table 3-1. Controls, Jacks, and Indicators

1. **Front Panel:**	The 260-6 Volt-Ohm-Milliammeter is a large, easy-to-read 4¼ inch indicating instrument. Below the Instrument are four controls and eight circuit jacks. Switch positions and circuit jacks are marked in white characters for easy reading.
2. **Range Switch:**	Has 12 positions: May be turned in either direction. There are 5 voltage positions, 4 direct current positions, and 3 resistance positions used to select desired ranges.
3. **Function Switch:**	The function switch has three positions: —DC, +DC and AC. To measure DC current or voltage, set the

d. Open the ground side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

e. Read the current on the black DC scale. Use the 0-50 figures to read directly in microamperes.

4.13 DIRECT CURRENT MEASUREMENT 0-1mA THROUGH 0-500mA RANGE

a. Set the function switch at +DC (Figure 4-7).

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Set the range switch at one of the four range positions marked 1 mA, 10 mA, 100 mA or 500 mA.

d. Open the grounded side of the circuit in which the current is being measured. Connect the VOM in series with the circuit. Connect the red test lead to the positive side and the black test lead to the negative side.

e. Turn the power on. Read the current in milliamperes on the black DC scale. For the 1mA range, use the 0-10 figures and divide by 10. For the 10mA range, use the 0-10 figures directly. For the 100mA range, use the 0-10 figures and multiply by 10. For the 500mA range, use the 0-50 figures and multiply by 10.

f. Turn the power off and disconnect the test leads.

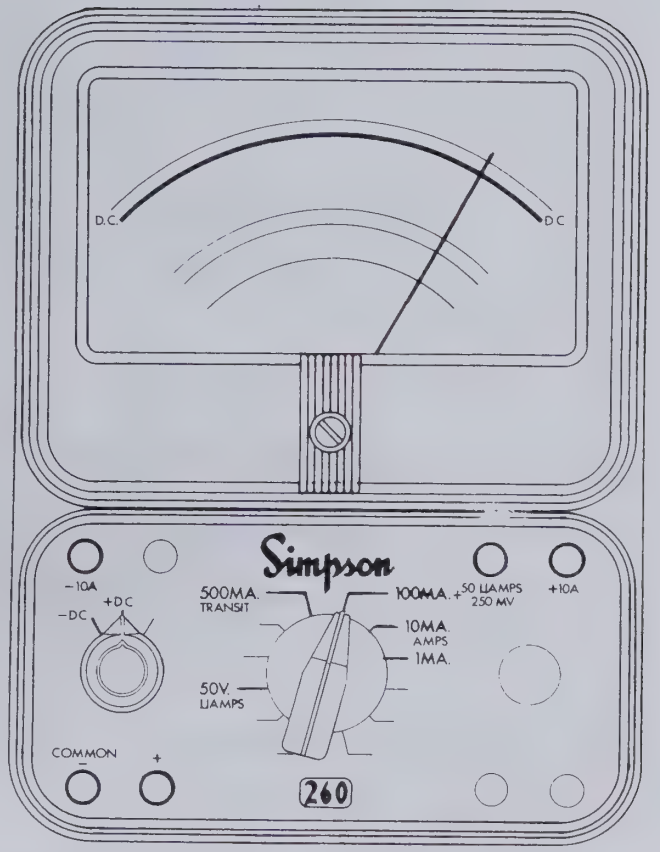


Figure 4-7. Jacks and Switch Positions for Measuring Direct Current

Figure 3-1. Front Panel Controls, Jacks and Indicators

function switch at the —DC or +DC position, depending on the polarity of the signal applied across the test leads. To measure AC voltage set the function switch to the AC position. For resistance measurement, the switch may be set in either the +DC or —DC position. The polarity of the internal ohmmeter battery voltage at the (+) pos jack is identical to the function switch polarity setting and opposite at the (—) common jack.

4. **Zero Ohms:** This control is used to compensate for variation in the voltage of the internal batteries.

5. **Circuit Jacks:** There are eight jacks on the front panel marked with the functions they represent (Figure 3-1). These jacks provide the electrical connections to the test leads. The COMMON (—) jack is used (in conjunction with the black test lead) as the reference point for the measurement of all the functions with the exception of the 10A range. (Refer to the Operation Section for details.)

6. **Pointer Adjust For Zero:** With the Volt-Ohm-Milliammeter in an operating position, check that the pointer indicates zero at the left end of the scale when there is no input. If pointer is off zero, adjust the screw located in the case below the center of the dial. Use a small screwdriver to turn the screw slowly clockwise or counterclockwise until the pointer is exactly over the zero mark at the left end of the scale. With the indicating pointer set on the zero mark, reverse the direction of rotation of the zero adjuster. Rotate the zero adjuster a sufficient amount to introduce mechanical freedom or "play" but insufficient to disturb the position of the indicating pointer. This procedure will avoid disturbances to the zero setting by subsequent changes in temperature, humidity, vibration, and other environmental conditions.

4.11 DIRECT CURRENT MEASUREMENT

WARNING

- Do not change the range setting of the Range or Function Switches while the circuit under measurement is energized.
- Never disconnect the test leads from the circuit under measurement while the circuit is energized.
- Always turn the power off and discharge all the capacitors before the setting of the switches is changed, or the leads disconnected.
- Never exceed the Circuit-To-Ground voltage of the instrument (1000 V max; Table 1-1, item 16).
- Always connect the Instrument in series with the ground side of the circuit.
- In all direct current measurements, make certain the power to the circuit being tested has been turned off before connecting and disconnecting test leads or restoring circuit continuity.

4.12 DIRECT CURRENT MEASUREMENT 0-50μA RANGE

a. Set the function switch at +DC.

b. Plug the black test lead into the —COMMON jack and the red test lead into the +50μAMPS/250mV jack.

c. Set the range switch at 50μAMPS (dual position with 50V).

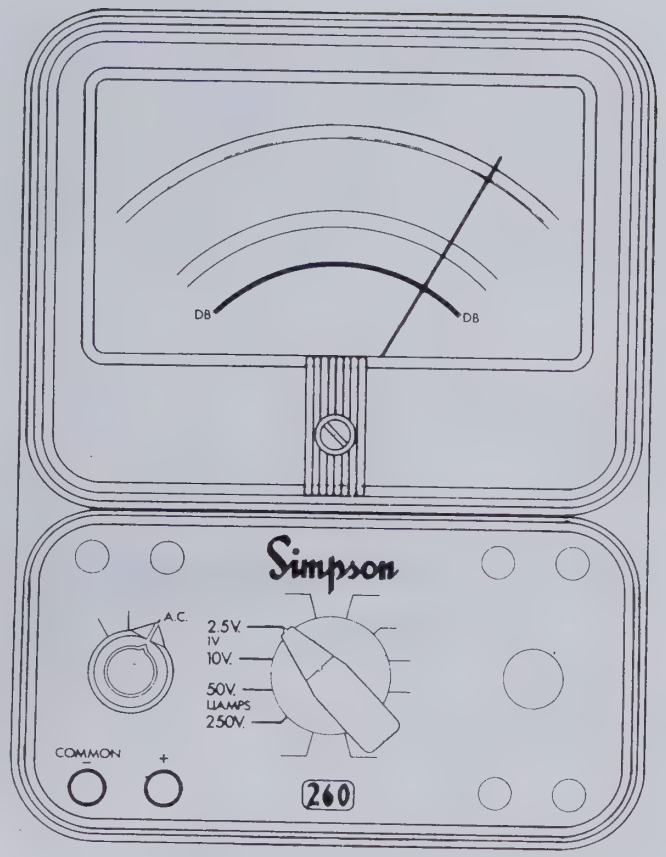


Figure 4-6. Jacks and Switch Positions for Measuring Decibels

SECTION IV
OPERATION

WARNING

Before proceeding with the operation of the 260, review the SHOCK HAZARD definition printed on page vi of the manual. Also, do not use this Instrument and its accessories on induction heating, X-ray machines, or power sub-stations where high voltage and low impedance equipment is used.

4.1 GENERAL

4.1.1 This section of the manual contains information required to use and operate the 260 in a safe and proper manner.

4.2 SAFETY PRECAUTIONS

4.2.1 The 260 should only be used by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury.

4.2.2. Do not work alone when making measurements of circuits where a shock hazard might exist. Notify a nearby person that you are making, or intend to make such measurements.

4.2.3 Locate all voltage sources and accessible current paths before making measurement connections. Be sure the equipment is properly grounded and the right rating and type of fuse(s) is installed. Set the Instrument to the proper range before applying power.

CAUTION

Continuity of all parts required to be connected to the protective grounding means shall be verified by either visual inspection or electrical test.

REMEMBER: Voltages may appear unexpectedly in defective equipment. An open bleeder resistor may result in a capacitor retaining a dangerous charge. Turn off power and discharge all capacitors before connecting or disconnecting test leads to and from the circuit being measured.

4.2.4 Inspect the test leads for cracks, breaks or crazes in the insulation, prods, and connectors before each use. If any defects are noted, replace the test leads immediately.

4.2.5 Do not make measurements in a circuit where corona is present. Corona can be identified by a pale blue color emanating from sharp metal points in the circuit, or by a buzzing sound, or by the odor of ozone. In rare instances, such as around germicidal lamps, ozone might be generated as a normal function. Ordinarily, the presence of ozone indicates the presence of high voltage and probably an electrical malfunction.

4.2.6 Hands, shoes, floor, and workbench must be dry. Avoid making measurements under humid, damp, or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or Instrument.

4.2.7 For maximum safety, do not touch test leads or Instrument while power is applied to the circuit under test.

4.2.8 Use extreme caution when making measurements where a dangerous combination of voltages could be present, such as in an r-f amplifier.

4.2.9 Do not make measurements using test leads of lesser safety than those originally furnished with the Instrument.

4.2.10 Do not touch any object which could provide a current path to the common side of the circuit under test or power line

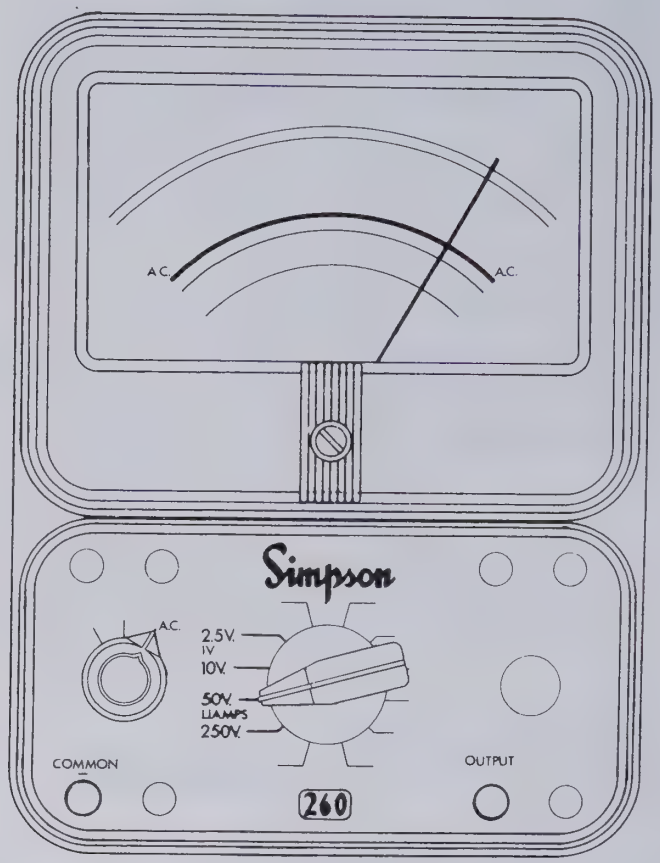


Figure 4-5. Jacks and Switch Positions for Output Measurement

c. Set the range switch at one of the range positions marked 2.5V, 10V, 50V, or 250V.

d. Connect the test leads across the circuit being measured with the black test lead to the ground side.

e. Turn on the power in the test circuit. Read the output voltage on the appropriate AC voltage scale. For the 0-2.5V range, read the value directly on the scale marked 2.5 VAC. For the 10V, 50V, or 250V ranges, use the red scale marked AC and read the black figures immediately above the scale.

4.10 DECIBEL MEASUREMENT

a. For some applications, output voltage and audio frequency voltage are frequently measured in terms of decibels. The decibel scale (dB) at the bottom of the dial is marked from —20 to +10 (Figure 4-6).

b. To measure decibels, read the dB scale in accordance with instructions for measuring AC. For example, when the range switch is set on the 2.5V position, the dB scale is read directly.

c. The dB readings on the scale are referenced to zero dB power level of .001 watt in 600 ohms, or 0.775 VAC across 600 ohms.

d. For the 10V range, read the dB scale and add +12 dB to the reading. For the 50V range, read the dB scale and add +26 dB to the reading. For the 250V range, read the dB scale and add +40 db to the reading.

e. If the zero dB level is .006 watt in 500 ohms, subtract 7 dB from the reading.

ground. Always stand on a dry insulating surface capable of withstanding the voltage being measured, or that could be encountered.

4.2.11 The range or function switch should only be changed when the power to the circuit under measurement is turned off. This will provide maximum safety to the user, eliminate arcing at the switch contacts, and prolong the life of the Instrument.

NOTE: Do not exceed the maximum rated circuit-to-ground voltage of the Instrument (Table 1-1, item 16).

4.2.12 POLARITY CORRECTION

4.2.13 When making DC measurements with the test leads connected to the + and COMMON jacks, polarity can be reversed with the function switch without reversing the test leads. When making measurements on the 50 μA/250 mV range, or 5A range, polarity can be corrected only by reversing the test leads.

NOTE: Change the range switch or function switch positions only when the power to the circuit being measured is turned off or when the test leads are disconnected. In addition to safety, this practice will eliminate arcing at the switch contacts and prolong the life of the Instrument.

4.3 DC VOLTAGE MEASUREMENT 0-250 mV RANGE

WARNING

Prior to making voltage measurements, review the SAFETY PRECAUTIONS listed in paragraph 4.2. Also, when using the 260 as a millivoltmeter, care must be taken to prevent damage to the indicating instrument from excessive voltage. Before using the 250 millivolt range, use the 1.0-volt DC range to determine that the voltage measured is not greater than 250 millivolts (or 2.5 volt DC).

a. Set the function switch at +DC (Figure 4-1).

b. Plug the black test lead in the — COMMON jack and the red test lead into the +50 μAMPS/250mV jack.

c. Set the range switch at 50 μAMPS (COMMON)position with 50V .

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Read the voltage on the black scale marked DC and use the figures marked 0-250. Read directly in millivolts.

4.4 DC VOLTAGE MEASUREMENT 0-1V RANGE

a. Set the function switch at +DC (Figure 4-1).

b. Plug the black test lead into the -COMMON jack and the red test lead into the +1V jack.

c. Set the range switch at 1V (COMMON position with 2.5V).

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Read the voltage on the black scale marked DC and use the figures marked 0-10. Then divide the reading by 10.

4.5 DC VOLTAGE MEASUREMENT 0-2.5 THROUGH 0-500V RANGE

a. Set the function switch at +DC (Figure 4-1).

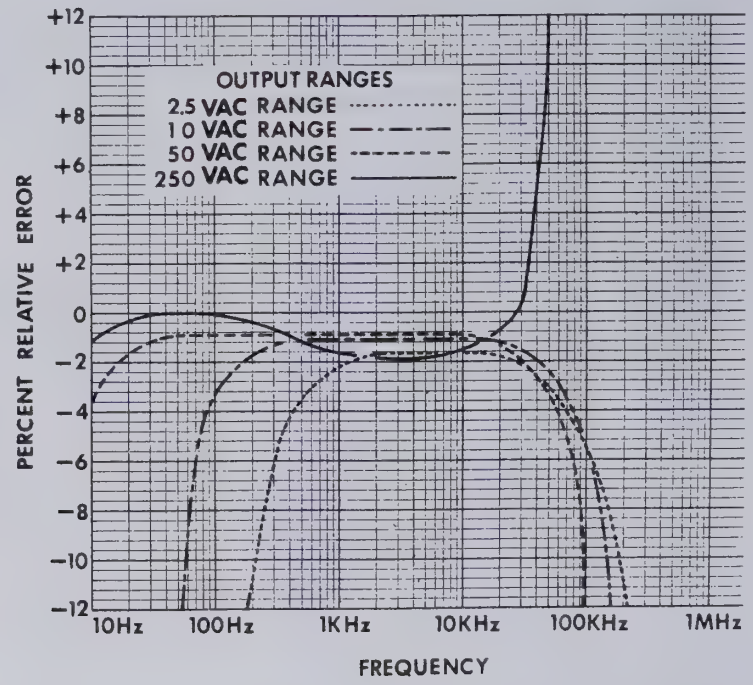


Figure 4-4. Frequency Response Output Ranges

d. Be sure the power is off in the circuit being measured and that all capacitors have been discharged. Connect the test leads to the circuit.

e. Turn on the power in the circuit being measured.

f. Read the voltage on the red scale marked AC. Use the 0-10 figures and multiply by 100.

4.9 OUTPUT VOLTAGE MEASUREMENT

4.9.1 It is necessary to measure the AC component of an output voltage where both AC and DC voltage levels exist. This occurs primarily in amplifier circuits. The 260 has a 0.1 μF, 400 volt capacitor in series with the OUTPUT jack. The capacitor blocks the DC component of the current in the test circuit, but allows the AC or desired component to pass on to the indicating instrument circuit. The blocking capacitor may alter the AC response at low frequencies but is usually ignored at audio frequencies (Figure 4-4).

CAUTION

When using OUTPUT, do not apply to a circuit where the DC voltage component exceeds 350 volts.

4.9.2 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-5).

b. Plug the black test lead into the -COMMON jack and the red test lead into the OUTPUT jack.

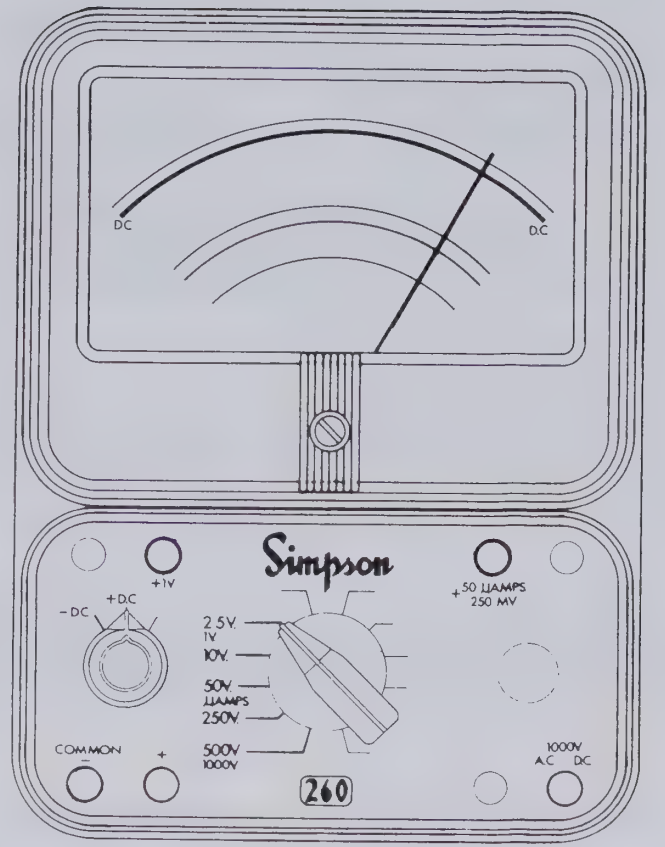


Figure 4-1. Jacks and Switch Positions for Measuring DC Voltage

b. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

c. Set the range switch at one of the five voltage range positions marked 2.5V, 10V, 50V, 250V or 500V.

NOTE: When in doubt as to the voltage present, always use the highest voltage range as a protection to the Instrument. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading. Be sure power is off in the circuit being measured and all capacitors discharged.

d. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Turn on the power in the circuit being measured.

f. Read the voltage on the black scale marked DC. For the 2.5V range, use the 0-250 figures and divide by 100. For the 10V, 50V, and 250V ranges, read the figures directly. For the 500V range, use the 0-50 figures and multiply by 10.

NOTE: Turn off power to the circuit and wait until the meter indicates zero before disconnecting the test leads.

c. Plug the black test lead into the -COMMON jack and the red test lead into the + jack.

d. Connect the test leads across the voltage source.

e. Turn on power in the circuit being measured.

f. For the 0-2.5V range read the value directly on the scale marked 2.5 VAC. For the 10V, 50V, and 250V ranges, read the red scale marked AC and use the black figure immediately above the scale. For the 500V range, read the red scale marked AC and use the 0-50 figures. Multiply the reading by 10.

4.8 AC VOLTAGE MEASUREMENT 0-1000V RANGE

WARNING

Be extremely careful when working in high voltage circuits. Do not touch the Instrument or test leads while the power is on in the circuit being measured.

4.8.1 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-3).

b. Set the range switch at 1000V (dual position with 500V).

c. Plug the black test lead in the COMMON jack and the red test lead in the 1000V jack.

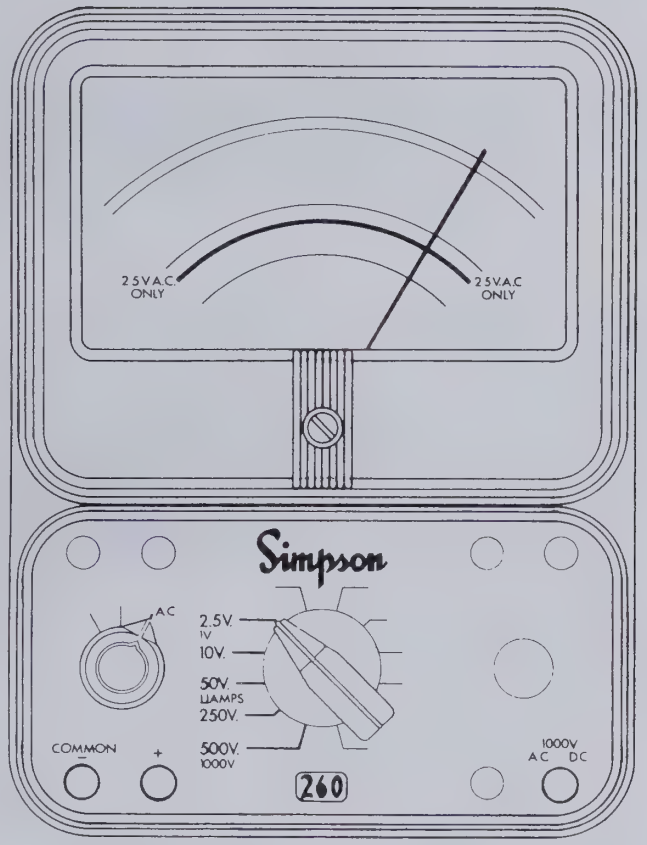


Figure 4-3. Jacks and Switch Positions for Measuring AC Voltage

4.6 DC VOLTAGE MEASUREMENT 0-1000V RANGE

WARNING

Be extremely careful when working with high voltage circuits. Do not touch the Instrument or test leads while power is on in the circuit being measured.

4.6.1 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at +DC (Figure 4-1).

b. Set the range switch at 1000V (dual position with 500V).

c. Plug the black test lead into the -COMMON jack and the red test lead into the 1000V jack.

d. Be sure power is off in the circuit being measured and all capacitors discharged. Connect the black test lead to the negative side of the circuit being measured and the red test lead to the positive side of the circuit.

e. Turn on power in circuit being measured.

f. Read the voltage using the 0-10 figures on the black scale marked DC. Multiply the reading by 100.

REMEMBER: Turn off power to the circuit and wait until the meter indicates zero before disconnecting the test leads.

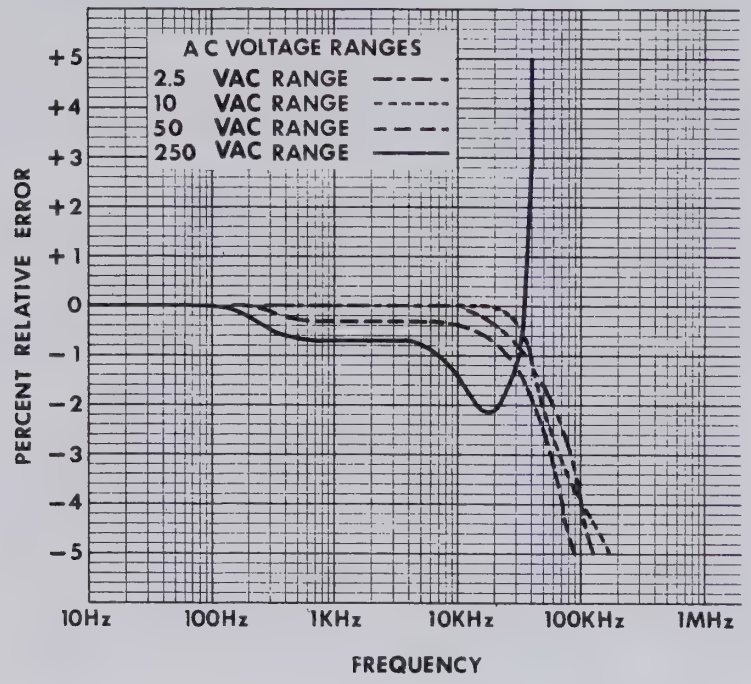


Figure 4-2. Frequency Response, AC Voltage Ranges

4.7 AC VOLTAGE MEASUREMENT 0-2.5 THROUGH 0-500V RANGE

CAUTION

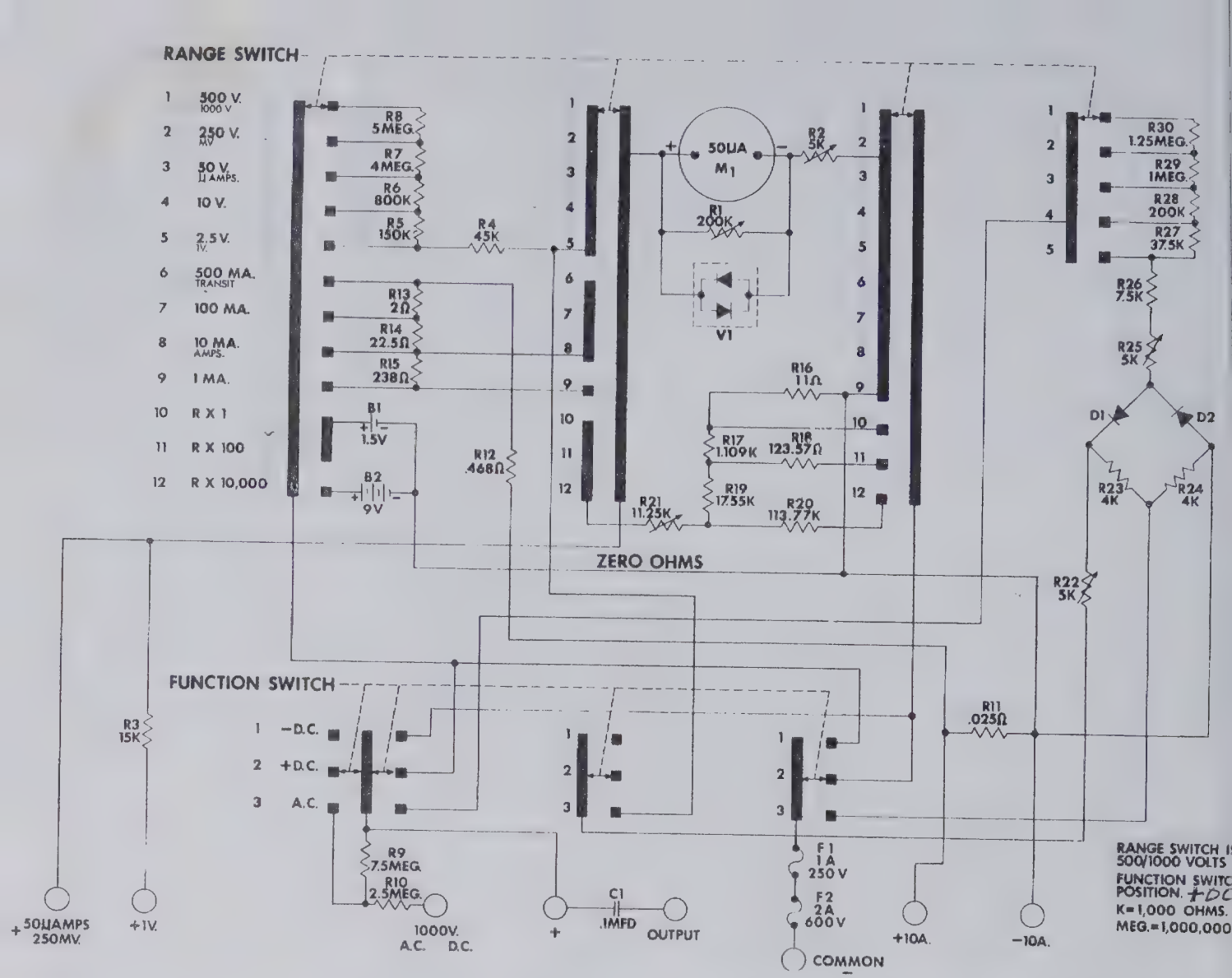
When measuring line voltage, such as from a 120 volt, 240 volt or 480 volt source, be sure that the range switch is set to the proper voltage position.

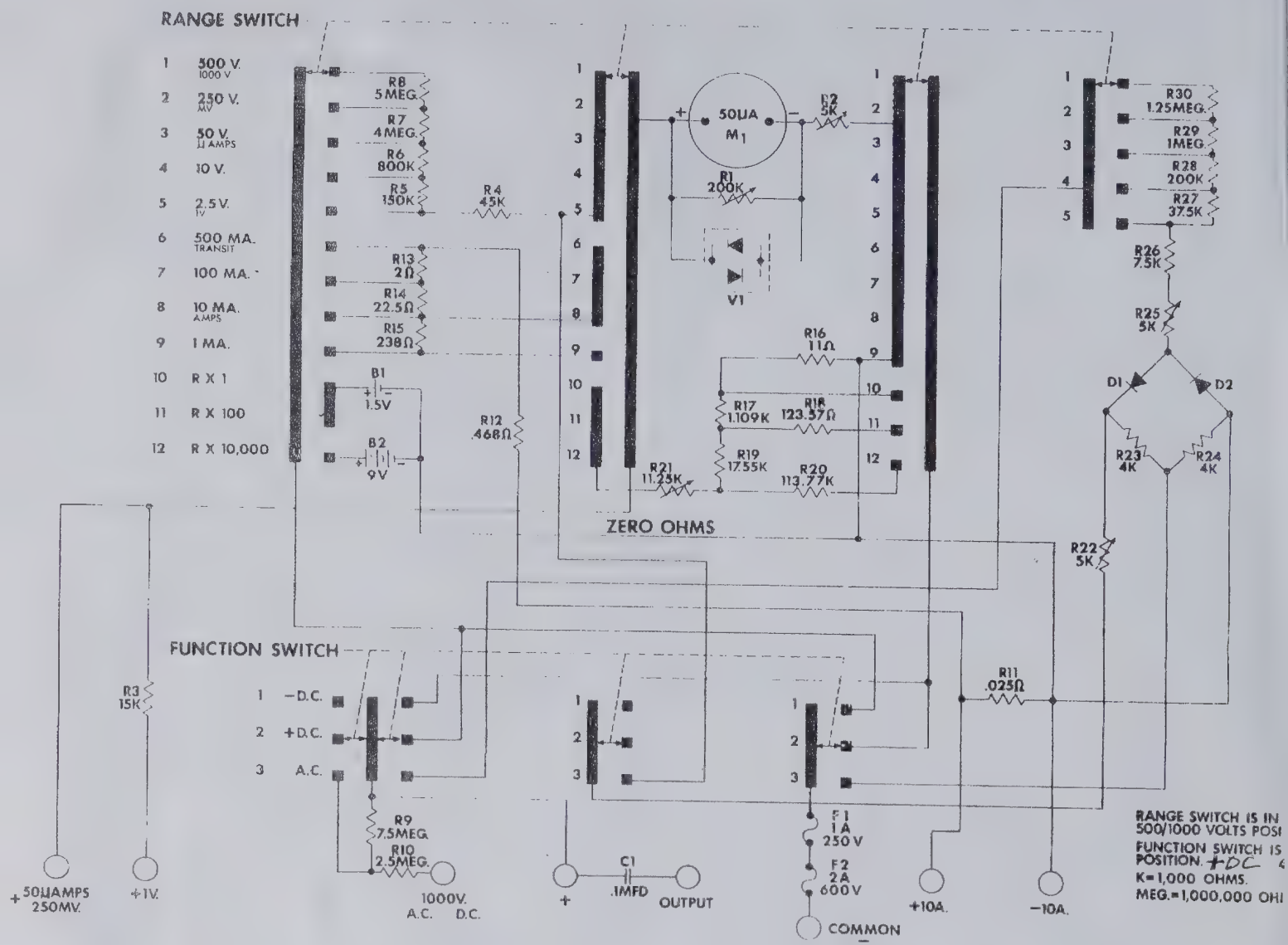
4.7.1 The 260 responds to the average value of an AC waveform. It is calibrated in terms of the rms value of a pure sine wave. If the waveform is nonsinusoidal, and depending upon its waveform, the reading may be either higher or lower than the true rms value of the measured voltage. Thus an error may be introduced if the 260 is used to measure a nonsinusoidal waveform. Also, accuracy is lessened at higher input frequencies (Figure 4-2).

4.7.2 Before proceeding with the following steps, review the Safety Precautions in Paragraph 4.2.

a. Set the function switch at AC (Figure 4-3).

b. Set the range switch at one of the five voltage range positions marked 2.5V, 10V, 50V, 250V or 500V. (When in doubt as to actual voltage present, always use the highest voltage range as a protection to the Instrument. If the voltage is within a lower range, the switch may be set for the lower range to obtain a more accurate reading.)


RANGE SWITCH
1 500 V. 1000 V
2 250 V. MV
3 50 V. 1/4 AMPS.
4 10 V.
5 2.5 V. 1V.
6 500 MA. TRANSIT
7 100 MA.
8 10 MA. AMPS.
9 1 MA.
10 R X 1
11 R X 100
12 R X 10,000
R8 5MEG.
R7 4MEG.
R6 800K
R5 150K
R4 45K
R13 2Ω
R14 22.5Ω
R15 238Ω
B1 1.5V
B2 9V
R12 .468Ω
50UA M1
R2 5K
R1 200K
V1
R16 11Ω
R17 1.109K
R18 123.57Ω
R19 17.55K
R20 113.77K
R21 11.25K
R30 1.25MEG.
R29 1MEG.
R28 200K
R27 37.5K
R26 7.5K
R25 5K
D1
D2
R23 4K
R24 4K
R22 5K
ZERO OHMS
FUNCTION SWITCH
1 -D.C.
2 +D.C.
3 A.C.
R3 15K
R9 7.5MEG.
R10 2.5MEG.
R11 .025Ω
F1 1A 250V
F2 2A 600V
C1 .1MFD
+50UAMPS 250MV.
+1V.
1000V. A.C. D.C.
+
OUTPUT
COMMON
+10A.
-10A.
RANGE SWITCH I
500/1000 VOLTS
FUNCTION SWITC
POSITION. +DC
K=1,000 OHMS.
MEG.=1,000,000


RANGE SWITCH
1 500 V. 1000 V
2 250 V. MV
3 50 V. 1/2 AMPS
4 10 V.
5 2.5 V. 1V
6 500 MA. TRANSIT
7 100 MA.
8 10 MA. AMPS
9 1 MA.
10 R X 1
11 R X 100
12 R X 10,000
R8 5MEG.
R7 4MEG.
R6 800K
R5 150K
R4 45K
R13 2Ω
R14 22.5Ω
R15 238Ω
B1 1.5V
B2 9V
R12 .468Ω
50UA M1
R2 5K
R1 200K
V1
R16 11Ω
R17 1.109K
R18 123.57Ω
R19 17.55K
R20 113.77K
R21 11.25K
ZERO OHMS
R30 1.25MEG.
R29 1MEG.
R28 200K
R27 37.5K
R26 7.5K
R25 5K
D1
D2
R23 4K
R24 4K
R22 5K
R11 .025Ω
FUNCTION SWITCH
1 -D.C.
2 +D.C.
3 A.C.
R3 15K
R9 7.5MEG.
R10 2.5MEG.
C1 .1MFD
F1 1A 250V
F2 2A 600V
+50UAMPS 250MV.
+1V.
1000V. A.C. D.C.
+
OUTPUT
COMMON
+10A.
-10A.
RANGE SWITCH IS IN 500/1000 VOLTS POSI
FUNCTION SWITCH IS POSITION. +DC
K=1,000 OHMS.
MEG.=1,000,000 OHI

Quality is the indispensable component of every Simpson instrument . . . . . .

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

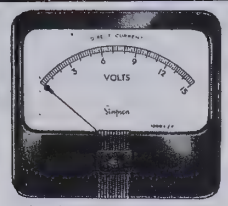
VACUUM TUBE VOLT-OHMMETER

MODEL 303

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago, Illinois 60644
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

Simpson panel instruments...



4½" RECTANGULAR

1375 STOCK TYPES

...plus HUNDREDS MORE, custom-built from standing tools ✳

INSTRUMENTS THAT STAY ACCURATE

✳ Send us your special meter requirements today. Let our top-flight engineers work out solutions or make recommendations *best suited* to your needs.

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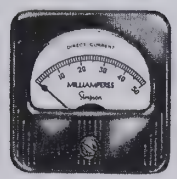
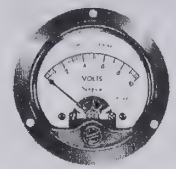


2½ RECTANGULAR
ACCURACY: ±2%

6" RECTANGULAR
ACCURACY: ±2%

1½", 2½", 3½", 4½"
WIDE VUE
ACCURACY: ±2%



2½" or 3½" ROUND
ACCURACY: ±2%

EDGEWISE
ACCURACY: DC ±2%
SCALE LENGTH: 1⅞"

ELAPSED TIME INDICATOR
110/220 VOLTS

See the Simpson ADD-A-TESTER ADAPTERS they will increase the versatility of your 260 or 270 VOM'S.

TRANSISTOR TESTER
Model 650 .....$29.95
DC VTVM
Model 651 .....$39.95
TEMPERATURE TESTER
Model 652 .....$39.95
AC AMMETER
Model 653 .....$19.95
AUDIO WATTMETER
Model 654 .....$19.95
MICROVOLT ATTENUATOR
Model 655 .....$19.95
BATTERY TESTER
Model 656 .....$19.95
MILLIOHMMETER
Model 657 .....$44.95
DC AMMETER
Model 661 .....$19.95

WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

ACCESSORY PROBES

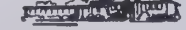
H.F.-R.F. PROBE—Part No. 0073 .....$ 8.75

H.V. PROBE—Part No. 0074 .....$11.95

PLAIN OR ROLL-TOP CASE FOR 303 AVAILABLE

Simpson ELECTRIC COMPANY

5200 Kinzie St., Chicago 44, Illinois • Phone: EStebrook 9-1121 • Long Distance Dial 312
In Canada: Bach-Simpson, Ltd., London, Ontario



LAC DU FLAMBEAU PLANT
WISCONSIN

LAKE STREET PLANT
CHICAGO

KINZIE STREET PLANT
CHICAGO

AURORA PLANT
AURORA, ILL.

Ohio, Dayton 45404 SREPCO Electronics Div. of Pioneer Standard Electronic, Inc. 314 Leo Street	Area Code 513 224-0871
Oklahoma, Tulsa 74011 Tri-State Instrument Lab. 3244 East 15th Street, Box 5057	Area Code 918 936-0489
Oregon, Portland 97217 Industrial Instrument Repair Lab. 1910 N. Killingsworth St.	Area Code 503 285-6629
Pennsylvania, Philadelphia 19115 Sunshine Scientific Instrument 1810 Grant Avenue	Area Code 215 673-5600
Texas, Dallas 75204 Ultra Instrument Lab., Inc. 3515 Swiss Avenue, Suite 117	Area Code 214 826-6395 826-6396
Virginia, Falls Church 22046 United Instrument Lab. Inc. 102 W. Jefferson St.	Area Code 703 532-4123
D.C., Washington 20001 Electronic Wholesalers. Inc. 2345 Sherman Avenue N.W.	Area Code 202 483-5200
Washington, Seattle 98119 The Instrument Lab. Inc. 934 Elliott Avenue West	Area Code 206 283-5850
Wisconsin, Milwaukee 53202 Electro-Mechano 261 East Erie Street	Area Code 414 272-4050

OPERATOR'S MANUAL

VACUUM TUBE VOLT-OHMMETER
MODEL 303

SIMPSON ELECTRIC COMPANY

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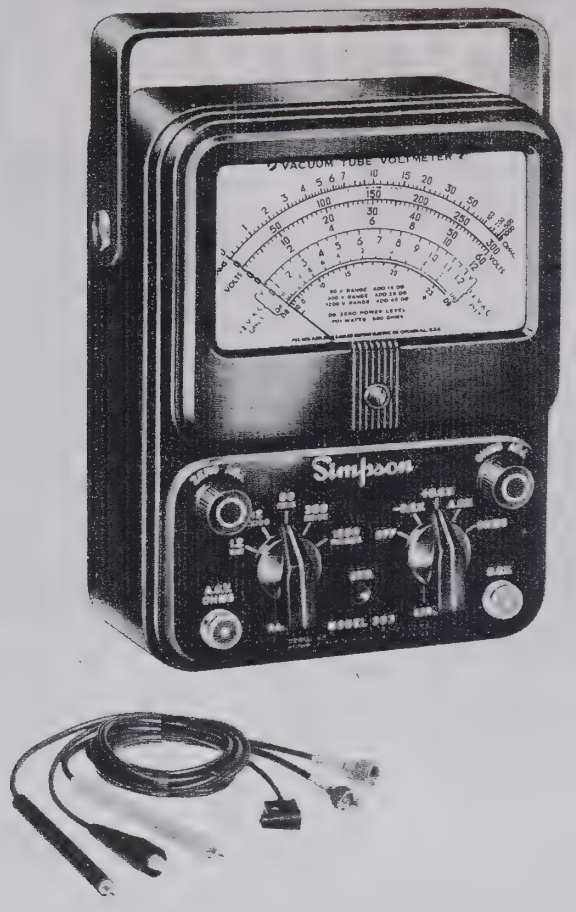

FIGURE 1. SIMPSON VACUUM TUBE VOLT-OHMMETER
MODEL 303

Minnesota, Minneapolis 55411 Instrumentation Services Inc., 917 Plymouth Avenue	Area Code 612 521-8803
Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 367-9800
New York, Buffalo 14216 Electrical Instrument Labs. 932 Hertel Avenue	Area Code 716 392-2726
N. Y., Great Neck, Long Island 11022 Simpson Instrument Sales & Service, Inc. 130 Gutter Mill Road	Area Code 212 683-0674 Area Code 516 482-3103
New York, Long Island City 11103 A & M Instrument Inc. 48-01 31st Avenue	Area Code 212 726-4343
New York, New York 10011 Electro-Tech Equipment Company 85 Tenth Avenue	Area Code 212 675-2400
New York, Syracuse 13215 Syracuse Instrument Lab. 4895 South Avenue Box 96	Area Code 315 492-1651
New York, Vestal 13850 Compton Industries Inc. 333 Vestal Parkway East P.O. Box 351	Area Code 607 748-3349
North Carolina, Charlotte 28206 Electro-Tech Inc. 3107 Gullman Avenue	Area Code 704 333-0326
Ohio, Cleveland 44135 Weschler Electric Company 4250 W. 130th Street	Area Code 216 251-4609
Ohio, Cleveland 44103 Pioneer-Standard Electronics, Inc. 5403 Prospect Avenue	Area Code 216 432-0010

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

VACUUM TUBE VOLT-OHMMETER
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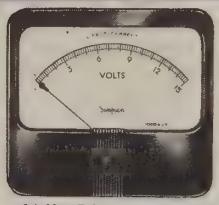

4½" RECTANGULAR

1375 STOCK TYPES

...plus HUNDREDS MORE, custom-built from standing tools ✻

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✻ Send us your special meter requirements today. Let our top-flight engineers work out solutions or make recommendations *best suited* to your needs.

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2½ RECTANGULAR
ACCURACY: ±2%

6" RECTANGULAR
ACCURACY: ±2%

1½", 2½", 3½", 4½"
WIDE VUE
ACCURACY: ±2%

2½" or 3½" ROUND
ACCURACY: ±2%

EDGEWISE
ACCURACY: DC ±2%
SCALE LENGTH: 1⅞"

ELAPSED TIME
INDICATOR
110/220 VOLTS

See the Simpson ADD-A-TESTER ADAPTERS they will increase the versatility of your 260 or 270 VOM'S.

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DC VTVM Model 651	$39.95
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AC AMMETER Model 653	$19.95
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MICROVOLT ATTENUATOR Model 655	$19.95
BATTERY TESTER Model 656	$19.95
MILLIOHMMETER Model 657	$44.95
DC AMMETER Model 661	$19.95

OPERATOR'S MANUAL

VACUUM TUBE VOLT-OHMMETER
MODEL 303

SIMPSON ELECTRIC COMPANY

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FIGURE 1. SIMPSON VACUUM TUBE VOLT-OHMMETER
MODEL 303

SECTION I

GENERAL DESCRIPTION

INSTRUMENT

The Simpson Model 303, as shown in figure 1, offers the service and research field a small, compact and rugged vacuum tube volt-ohmmeter, complete in every detail. The high input impedance and frequency response gives this instrument the characteristics necessary in dealing with the high resistance circuits and high frequencies encountered in FM and television receiver servicing.

ROLL TOP MODEL

The Model 303 RT is the same instrument supplied with a convenient, all phenolic, roll top carrying case with a lead compartment sufficiently large to house the leads and line cord.

TEST LEADS

The Model 303 is supplied with a DC test probe, an AC and ohms test probe and a ground lead. An alligator clip is also supplied and may be slipped over the end of the test probe if desired.

POWER REQUIREMENTS

The Model 303 is designed for operation on a nominal 115 volt, 50-60 cycle line.

EXPORT VERSION

220/110 volts, 50-60 cycles (see page 24).

ACCURACY

Accuracy is 3% D.C. and 5% A.C. (60 cycle sine wave) of full scale deflection.

ACCESSORY PROBE

A Crystal R.F. Probe may be purchased as an accessory for making R.F. voltage measurements (signal tracing).

ELECTRICAL SPECIFICATIONS

The Model 303 covers seven major functions in the measurement and testing of modern FM and TV receivers and in laboratory and research work, as follows:

D.C. VOLTAGE

Ranges - 1.2, 12, 60, 300, 1200
Input resistance - 10 megohms for all ranges
D.C. Probe - With one megohm isolating resistor
Polarity Reversing Switch

OHMS

Ranges - 1000 (10 ohms center)
100,000 (1000 ohms center)
1 megohm (10,000 ohms center)
10 megohms (100,000 ohms center)
1000 megohms (10 megohms center)

A.C. VOLTAGE

Ranges - 1.2, 12, 60, 300, 1200 volts
Impedance (with cable) approximately 210 uuf shunted by 275,000 ohms.

A.F. VOLTAGE

Ranges - 1.2, 12, 60 volts
Frequency Response - Flat to 100,000 cycles

GENERAL DESCRIPTION

DECIBELS

Zero Power Level = 1 milliwatt in 600 ohms
5 Ranges
−20 to +63 DB

GALVANOMETER

Zero Center for FM discriminator alignment

R.F. VOLTAGE (SIGNAL TRACING)

(With Accessory High Frequency Probe)
Range - maximum 20 volts peak
Frequency - 20kc to 100 mc
Capacity of Probe - 2.5uuf

VOLTAGE MEASUREMENTS DC

DC voltage is measured by applying the voltage through a voltage divider to the grid of one section of a 12AU7 tube. This causes an unbalanced condition between the two sections of the tube resulting in an indication on the meter proportional to the voltage applied.

VOLTAGE MEASUREMENTS AC

AC voltage is measured by applying the voltage directly or through a voltage divider to the plates of a 6AL5 tube where it is rectified and then measured the same as DC.

RESISTANCE MEASUREMENTS DC

DC resistance is measured by applying a voltage from an internal battery to the grid on one section of the 12AU7 tube through a voltage dividing network. This causes an unbalanced condition between the sections of the tube result-

ing in a deflection of the meter proportional to the resistance being measured.

SECTION II

OPERATION

CAUTION

When making high voltage measurements, slip the alligator clip over the test probe and clip the lead to the point under measurement. Always turn off power and discharge capacitors before connecting to or disconnecting from the circuit under test.

ZERO ADJUSTMENT (MECHANICAL)

Before turning on the power to the Model 303, be sure that the pointer is on zero. If pointer is off zero, adjust by means of the slotted screw located in the bakelite case directly below the meter scale. Use a small screwdriver to turn this adjustment slowly right or left until the pointer is directly over the zero point on the scale.

OPERATION OF CONTROLS

CIRCUIT SELECTOR SWITCH

When the CIRCUIT selector switch is in the OFF position, the power is turned off. Turning this switch to the right turns on the power and also selects the circuit to be used. The two positions are marked +D.C.V. and −D.C.V. They constitute a meter reversing switch and indicate the po-

larity of the D.C. probe lead. This makes it possible to keep the ground lead connected to the chassis or the common connection to read either polarity, and to use the probe lead to check voltages at various points in the circuit.

In the A.C.V. position the circuit is arranged for A.C. voltage measurements through use of a vacuum tube rectifier.

In the OHMS position an internal battery and associated resistors are switched into the circuit to provide for resistance measurements.

The A.C.V.—OHMS probe is used for both A.C. Volts and resistance measurements.

RANGE SELECTOR SWITCH

The RANGE selector switch selects the desired range for the circuit indicated by the position of the circuit selector switch.

ZERO ADJUSTMENT (ELECTRICAL)

After the power has been turned on and the circuit selector switch placed in one of the voltage measuring positions, the knob marked ZERO ADJ. should be turned to the right or left until the pointer is directly over the zero point on the scale. When making this adjustment, the probe being used should be connected to the ground lead. When changing ranges or circuits it may be necessary to readjust zero.

OHMS ADJUSTMENT

With the circuit selector switch placed in the OHMS position and the range selector switch in one of the resistance measuring positions, the pointer will rest near the

right end of the scale (test leads open.) The knob at the right of the meter marked OHMS ADJ. should be turned right or left until the pointer is directly over the last mark at the right end of the scale, the point of infinite resistance.

MEASURING D.C. VOLTAGES

1. Place the circuit selector switch in the +D.C.V. or the −D.C.V. position, depending on the polarity of the voltage to be measured.
2. Rotate the range selector switch to any one of the five voltage positions (1.2 to 1200V) required. While the 303 will not be damaged easily, select a range higher than the voltage to be measured. After the first reading, the switch can be reset to a lower range, if needed, to get a more accurate reading.
3. Plug the ground lead into the jack marked GND. and the D.C. probe lead to the connector marked D.C.V. Connect the D.C. probe tip to the ground lead and rotate the zero adjust control to set the meter pointer directly over the "0" mark on the scale.
4. Connect the ground lead clip to the common side of the circuit under test.
5. Turn on the power to the circuit under test and place the end of the probe on the point to be checked. If desired, slip an alligator clip over the end of the probe and clip it to the point to be checked before power is turned on. If the pointer deflects to the left of zero, the polarity is incorrect; place the circuit selector switch in the other D.C.V. position.
6. Read the voltage on the black arc second from the top, marked VOLTS, reading the figures as follows:

   1.2 volt range - read 0-12 and divide by 10

12 volt range - read 0-12 directly
60 volt range - read 0-60 directly
300 volt range - read 0-300 directly
1200 volt range - read 0-12 and multiply by 100

NOTE: To measure more than 1200 volts D.C. see information on high voltage accessory probe in section V.

ZERO CENTER DC VOLTS

1. Place the circuit selector switch in the position marked –D.C.V. or +D.C.V. With the D.C. probe connected to the ground lead, rotate the ZERO ADJ. knob until the meter pointer is exactly over the red line marked ZERO CENTER.
2. Rotate the range selector switch to a range at least twice the probable voltage to be measured and make connections as for D.C. volts.
3. Observe the indication on the arc of the scale marked VOLTS. Positive voltage on the probe lead will be indicated to the right of center and negative voltage to the left of center with the selector switch set at +D.C.V. Each side represents one-half of the range being used. For example, when the 60 volt range is being used, each half of the scale represents 30 volts and each division 1 volt.

   The purposes for which the zero center scale is used usually do not require an accurate measurement of voltage but merely an indication of a balanced condition. Such a use is illustrated on the alignment of a discriminator where a balanced condition will result in a zero center indication while an unbalanced condition will cause either a positive or negative deflection.

MEASURING A.C. VOLTS

EFFECT OF WAVEFORM

The Model 303 vacuum tube voltmeter is calibrated using a sinusoidal signal. The circuitry is such that it is considered a peak voltage reading type. Since this is the case, the AC and DBM scales are calibrated using effective values based on true sine waves. When it is known that other than sinusoidal signals are being measured, it must be recognized that the accuracy as specified for sinusoidal input will not apply.

MEASURING A.C. VOLTS

1. Place the circuit selector switch in the A.C.V. position.
2. Rotate the range selector switch to any one of the five voltage positions required, from 1.2 to 1200 V.
3. Plug the ground lead into the jack marked GND. Connect the A.C. probe to the connector marked A.C.V. Connect the probe tip to the ground lead and rotate the zero adjust control to set the meter pointer directly over the "0" mark on the scale.
4. Connect the ground lead clip to the common side of the circuit under test.
5. Turn on power for the circuit under test and hold the tip of the probe against the point to be checked. To avoid accidental shock, keep the free hand away from the chassis or any part of the circuit.
6. For the 1.2 volt range, read the voltage on the red arc third from the top marked 1.2V AC ONLY, reading the figures directly. For the other ranges, use the black arc second from the top, reading the figures as follows:

   12 volt range - read 0–12 directly
   60 volt range - read 0–60 directly
   300 volt range - read 0–300 directly
   1200 volt range - read 0–12 and multiply by 100

VOLUME LEVEL MEASUREMENTS

Connect the Model 303 as for AC voltage measurements.

When using the 1.2 volt range read decibels on the red DB scale.

When using the 12 volt range read decibels on the black DB scale.

When using the 60, 300 or 1000 volt range, use the black DB scale and add to the reading the number of DB appearing opposite the range in the chart directly below the DB scales. The zero power level is .001 watt in 600 ohms. Conversion may be made to the .006 watt–500 ohm level by adding algebraically –7 DB.

RESISTANCE MEASUREMENTS DC

1. Place the circuit selector switch in the position marked OHMS.
2. Rotate the range selector switch to any one of the five ranges required (R x 1 to Rx1MEG).
3. Plug the ground lead into the jack marked GND. Connect the OHMS probe to the connector marked OHMS.
4. The pointer will rest near the right end of the scale (without test leads shorted). Adjust OHMS ADJ. control until meter reads full scale. With leads shorted, meter should read zero (left end of scale). It may be necessary to adjust the ZERO ADJ. knob with leads shorted after which the full scale point should be rechecked with the test leads open.
5. Read ohms on the top arc of the scale marked OHMS. Read the figures as follows:
   Rx1 (1000 ohms) range–read 0–1000 directly
   Rx100 (100,000 ohms) range – multiply by 100
   Rx1K (1,000,000 ohms) range – multiply by 1000
   Rx10K (10,000,000 ohms) range – multiply by 10,000
   Rx1 MEG (1,000,000,000 ohms) range–multiply by 1,000,000

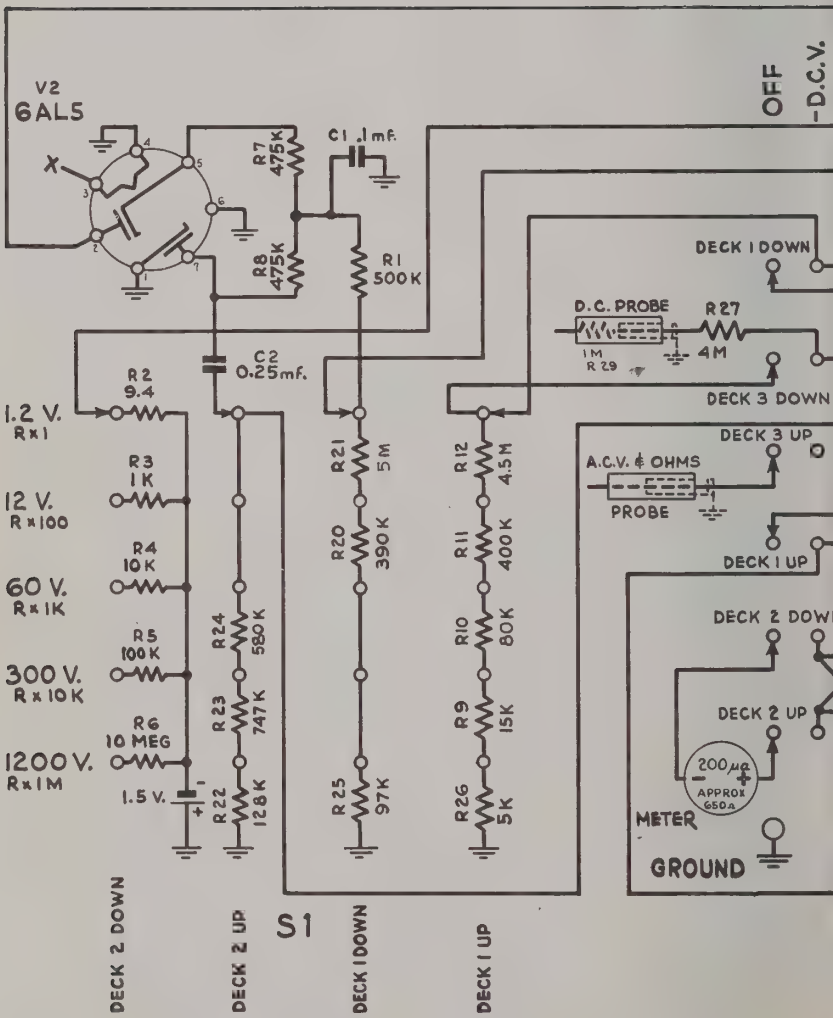
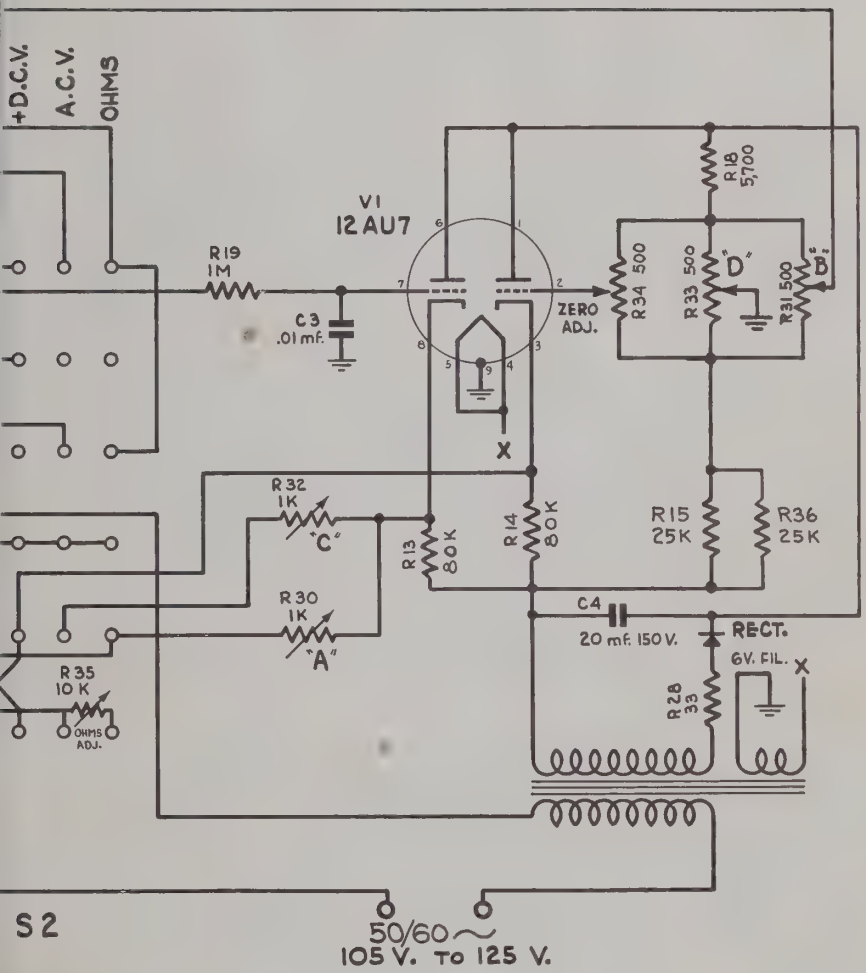


FIGURE 2. SIMPSON VACUUM TUBE VOL



-OHMMETER MODEL 303, SCHEMATIC DIAGRAM

SECTION III

MAINTENANCE

CARE

The Model 303 is a very rugged instrument designed to take the wear and tear of every day service work. Nevertheless, it should receive the care given to other fine electronic equipment and care should be used against dropping or other excessively rough treatment.

REPLACEMENT OF BATTERY

The 1.5V battery used as a current source for the ohmmeter will give a long service in the Model 303 but when replacement is necessary, a new battery can be slipped into the clamp holding the battery in place. It will be necessary to remove the Model 303 from its case which can be done by removing the four screws in the bottom of the case. When inserting the battery, be certain that the polarity is correct.

CALIBRATION

The Model 303 has been carefully calibrated at the factory and no further changes should be necessary. However, in case recalibration is required at any time, use the following procedure:

1. Allow the Model 303 to warm up for approximately 1 hour. Place the range selector switch in the 1.2 V position.
2. Place the circuit selector switch in the −D.C. position. Turn the ZERO ADJ knob to the extreme right and note

the reading on any scale. Then turn the circuit selector switch to the +D.C. position and turn the ZERO ADJ to the extreme left. Note the reading.

If there is any difference between the two readings in the above step, adjust potentiometer "D" (located inside the instrument) until these two readings are approximately equal.

3. Place the circuit selector switch in the −D.C. position. Adjust the ZERO ADJ knob so the meter indicates zero. Place the circuit selector in the A.C.V. position and adjust potentiometer "B" (located on the chassis) until the meter indicates zero.
4. Place the circuit selector switch in the −D.C. position and set the range selector switch to the 1.2 V range. Apply a known D.C. voltage to the D.C. probe which has a corresponding polarity and is within the limit of the range selected. Adjust potentiometer "A" (located on the chassis) until the meter indicates the calibrating voltage correctly. For calibration at the factory, a voltage is selected which will provide about 2/3 of full scale deflection.
5. Place the circuit selector switch in the A.C.V. position and apply a known A.C. voltage to the A.C. probe. Adjust potentiometer "C" (located on the chassis) until the meter indication corresponds to the known voltage.

REPLACEMENT OF TUBES

The 6AL5 tube is used as a rectifier for A.C. voltages. The 12AU7 tube is used in the bridge circuit for all measurements.

When replacing a tube, it is advisable to use a tube which has been aged for 48 hours (connected in a circuit with a small amount of plate current flowing). If the two sections of the tube vary too much in characteristics, the calibration will be affected; also the zero shift between ranges will be greater than normal.

REPAIR OR PARTS REPLACEMENT

A list of authorized Repair Stations and Parts Depots is shown in the rear of the manual. Contact your nearest Repair Station to obtain service or repair for your instrument. If you wish to order a replacement part, use the Simpson part number and send the order to your nearest Parts Depot.

PARTS LIST

Reference Symbol	Description	Simpson Part No.
R1	Resistor, 500K ohms	1-114090
R2	Resistor, 9.4 ohms	0-008290
R3	Resistor, 1K ohms	1-113542
R4	Resistor, 10K ohms	1-113306
R5	Resistor, 100K ohms	1-113427
R6	Resistor, 10 Megohms	1-113434
R7	Resistor, 475K ohms	1-114180
R8	Resistor, 475K ohms	1-114180
R9	Resistor, 15K ohms	1-113347
R10	Resistor, 80K ohms	1-113313
R11	Resistor, 400K ohms	1-114092
R12	Resistor, 4.5 Megohms	1-114093
R13	Resistor, 80K ohms	1-113313
R14	Resistor, 80K ohms	1-113313

R15	Resistor, 25K ohms	1-113426
R18	Resistor, 5,700 ohms	1-114198
R19	Resistor, 1 Megohm	1-113392
R20	Resistor, 390K ohms	1-113502
R21	Resistor, 5 Megohms	1-113433
R22	Resistor, 128K ohms	1-114095
R23	Resistor, 747K ohms	1-114096
R24	Resistor, 580K ohms	1-114200
R25	Resistor, 97K ohms	1-114119
R26	Resistor, 5K ohms	1-113425
R27	Resistor, 4 Megohms	1-113362
R28	Resistor, 33 ohms	1-114098
R29	Resistor, 1 Megohm	1-113392
R30	Potentiometer, 1000 ohms	1-114079
R31	Potentiometer, 500 ohms	1-114182
R32	Potentiometer, 1000 ohms	1-114079
R33	Potentiometer, 500 ohms	1-114182
R34	Potentiometer, 500 ohms	1-114181
R35	Potentiometer, 10K ohms	1-114142
R36	Resistor, 25K ohms	1-113426
C1	Capacitor, 0.1 μf, 400 v, paper	1-113902
C2	Capacitor, 0.25 μf, 400 v, paper	1-113903
C3	Capacitor, 0.01 μf, 400 v, paper	1-113896
C4	Capacitor, 20 μf, 150 v, electrolytic	1-114105
S1	Switch, 5 position Range	1-114072
S2	Switch, 5 position Circuit	1-114073
	Knob for S1 and S2	3-260180
	Knob for ZERO ADJ and OHMS ADJ	1-113641
V1	Tube Socket, 9 pin miniature	10-890064
V2	Tube Socket, 7 pin miniature	10-890065

Chassis connector (A.C. probe)	10-890063
Chassis connector (D.C. probe)	10-890063
Cable connector (A.C. probe)	10-890066
Cable connector (D.C. probe)	10-890066
Tip Jack (Ground lead)	1-111728
Complete A.C. probe assembly	0068
Complete D.C. probe assembly	0067
Complete ground lead assembly	0069
Case, complete with handle	0-006378
Case, roll top, complete with inside case and handle	0-006379
Meter and panel	15-302303
Power transformer 220/110 V (50-60 cycles) (Export version)	1-117211
Power transformer 115 V (50-60 cycles) (Domestic)	1-119488
Resistor housing	3-260211
Battery 1.5 V	1-111801
Tube, 12AU7 (Aged 3-310744)	1-114083
Tube, 6AL5	1-114084
Carrying handle	3-310874
Selenium Rectifier	1-113619
Line Cord	1-114116

ACCESSORIES

High Frequency Probe	0073
D.C. High Voltage Probe (30KV)	0074

SECTION IV
APPLICATIONS

The high input resistance of the Simpson Volt-Ohmmeter Model 303 permits its use in many applications where a voltmeter of lower sensitivity would cause excessive cir-

cuit loading. The following suggestions are only a few of the uses for which it will be found to be a superior instrument.

PLATE VOLTAGE MEASUREMENTS

Inaccurate readings of plate voltage often result when a low resistance voltmeter is used, especially in the case of tube circuits which require high values of plate resistors. Such voltage can be accurately measured with the Simpson Volt-Ohmmeter Model 303, its low current drain resulting in a true reading.

PHASE INVERTER BALANCE

The two sections of a phase inverter circuit may be checked for balance with the Simpson Volt-Ohmmeter Model 303. With an audio signal generator connected to the input of the audio amplifier, the voltages at the grids and plates may be measured.

MEASUREMENT OF STAGE GAIN

The Simpson Volt-Ohmmeter Model 303 is an ideal instrument for measuring stage gain. The output of the signal generator may be checked and the amplified signal then measured at the plate of the tube of the stage being tested. The ratio of the voltage at input and output of a stage represents the stage gain.

AVC VOLTAGE

The use of the Simpson Volt-Ohmmeter Model 303 to measure AVC voltage is possible because the high input resistance of the Simpson Volt-Ohmmeter Model 303 has very little loading effect on such a circuit. Connecting the

Model 303 across the AVC network is often more convenient than using an output meter for alignment purposes, as the volume control may be set at its minimum position, and it is not necessary to disconnect the AVC to prevent it from interfering with the alignment procedure.

DISCRIMINATOR ADJUSTMENT

The zero center mark on the dial of the Simpson Volt-Ohmmeter Model 303 permits easy adjustment of a discriminator stage. Connected across the load resistors, the reading will be zero when in balance but will deflect to the right or left if the stage is unbalanced.

FM ALIGNMENT

By connecting the Simpson Volt-Ohmmeter Model 303 across the load resister of the limiter, a reading may be obtained for alignment purposes. Adjust the circuits for maximum indication. Manufacturer's instructions should be followed for exact procedure.

GRID VOLTAGE

The high input resistance of the Simpson Volt-Ohmmeter Model 303 makes it possible to measure voltage at the grids of tubes without excessive loading of the circuit. For example, the output of a local oscillator may be checked throughout the tuning range.

BIAS VOLTAGE

Bias voltages can be read accurately with the Simpson Volt-Ohmmeter Model 303. Its input resistance is so high that when connected across a bias resistor, the additional current drain is negligible.

COUPLING AND BY-PASS CONDENSERS

Inasmuch as a condenser presents low impedance to AC current, readings may be taken on both sides of the condenser and should be approximately the same unless the condenser is defective.

SIGNAL TRACING

The Simpson Volt-Ohmmeter Model 303 is very useful in signal tracing or examining a radio circuit at various points in audio or radio frequency circuits. Its low capacity HF probe permits it to be used on high frequencies found in FM and television work.

SECTION V

ACCESSORY PROBES

HIGH FREQUENCY PROBE FOR MODEL 303 VACUUM TUBE VOLT-OHMMETER

GENERAL DESCRIPTION

Frequency Response	Flat within ±10% from 20 KC to 100 MC
Voltage Range	0 – 20 Max. peak volts
Probe Input Capacity	2.5 $\mu\mu$f
Meter Calibration	R.M.S. value of sine wave
Meter Calibration Accuracy	±7.5% of full scale

The H.F. Probe part number 0073 for the Simpson Model 303 is designed for use on frequencies above the range of the regular A.C. probe furnished with the meter. The cable terminates with the same type of connecting plug.

The crystal diode in the probe body rectifies the voltage under test, charging the .01 uf capacitor proportionate to the positive peak value. This direct current is then fed through a resistor and into the D.C. input of the meter circuit where it is read directly on the scale in R.M.S. values.

To convert meter reading to peak value multiply by 1.414.

OPERATING INSTRUCTIONS

Connect the plug on the end of the cord to the jack marked D.C.V. and set the CIRCUIT selector switch to −D.C.V. Set the RANGE selector switch to the desired range. Connect the alligator clip to a ground connection and touch tip of probe to point being measured.

For the 1.2 volt range read voltage on the red scale marked 1.2 V A.C. ONLY.

For the 12 and 60 volt ranges read the black scale for volts. Note that the limit for voltages is 20 volts peak. This is 14.14 volts R.M.S. on the 60 volt range.

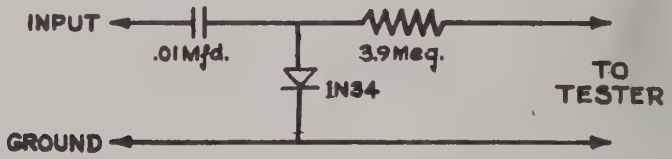


FIGURE 3. HIGH FREQUENCY PROBE FOR SIMPSON MODEL 303, SCHEMATIC DIAGRAM

D.C. HIGH VOLTAGE PROBE

DESCRIPTION

Accessory probe, Part number 0074, is available for use in high DC voltage measurements. It has a multiplier resistor in the probe handle which will increase the total input resistance to 1000 megohms. Basic instrument ranges will increase to 100 times the value marked on the front panel.

OPERATION

Remove the regular DC probe from the "D.C.V." panel receptacle and the ground lead from the "GND" jack. Plug the BLACK elbow connector into the GND. jack of the tester and clip the other end of the lead to the chassis. Connect the cable connector into the panel receptacle marked "D.C.V.". Proceed as for ordinary D.C. voltage measurements, with ranges equal to 100 times the range switch position markings.

RANGE SWITCH POSITION	INSTRUMENT RANGES WITH ACCESSORY H.V. PROBE
12V	0-1200 Volts DC
60V	0-6000 Volts DC
300V	*0-30,000 Volts DC

*Full range indication will be 30,000 volts; this is the maximum allowable voltage for safe operation.

WARNING

Do not apply more than 30,000 volts to the circuit of the High Voltage Probe. Greater voltage may cause irreparable damage to the probe as well as to the instrument.

EXPORT MODEL TRANSFORMER CONNECTIONS

PRIMARY RATING: 220/110 50-60 CYCLES

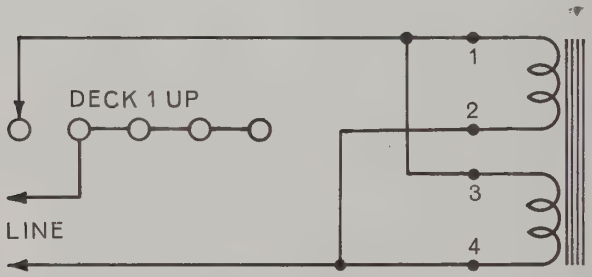


FIGURE 3A. CONNECTIONS FOR 110 VOLTS. OPERATION.

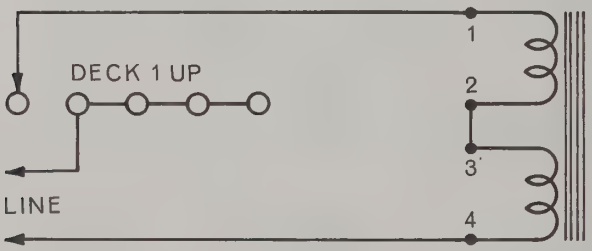


FIGURE 3B. CONNECTIONS FOR 220 VOLTS. OPERATION.

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

Arizona, Phoenix 85016 Metercraft Inc. 3308 N. 24th St.	Area Code 602 279-6249
California, San Diego 92111 Meter Master, Inc. 8139 Engineer Road	Area Code 714 278-2200
California, Glendale 91201 JSD Engineering Company 6915 San Fernando Road	Area Code 213 849-6187
California, Los Angeles 90022 Meter Master, Los Angeles Div. of Kierulff Electronics, Inc. 5645 East Washington Blvd.	Area Code 213 685-7313
California, San Francisco 94105 Pacific Electrical Instrument Lab. 111 Main Street	Area Code 415 421-7185
Canada, London, Ontario Bach-Simpson Ltd. 1255 Brydges Street P.O. Box 484	Area Code 519 451-9490
Colorado, Denver 80223 Meter-Master Instrument Service 2145 S. Kalamath Street	Area Code 303 934-4601 934-8614
Connecticut, New Haven 06511 Kaufman Instrument Labs Inc. 810 Dixwell Avenue	Area Code 203 776-7201
Florida, Miami 33136 Florida Precision Instrument Corp. 800 N.W. 7th Avenue	Area Code 305 374-1731
Florida, Orlando 32806 Electro Tech Inc. 307 - 27th Street	Area Code 305 423-5589

Georgia, Atlanta 30310 Electro-Tech Inc. 690 Murphy Ave. S.W.	Area Code 404 758-7205
Hawaii, Honolulu 96817 Electronic Systems Inc. 1622-26 Silva Street	851-457 811-132
Illinois, Chicago 60625 A & M Instrument, Incorporated 4801 North Ridgeway Avenue	Area Code 312 539-4460
Illinois, Chicago 60644 Pacific Indicator Company 5217 W. Madison Street	Area Code 312 261-1330
Illinois, Chicago 60644 Simpson Electric Company 5200 W. Kinzie Street	Area Code 312 379-1121
Kansas, Shawnee Mission 66205 Sturtz Instrument Co. 4705 Mission	Area Code 913 236-4705
Louisiana, New Orleans 70115 Industrial Instrument Works 3305 Tchoupitoulas Street	Area Code 504 895-5621
Maryland, Baltimore 21211 Edgerly Instrument Lab., Inc. 205 West 28th Street	Area Code 301 243-6611
Massachusetts, Cambridge 02138 A. S. Mancib 363 Walden Street	Area Code 617 864-2494
Massachusetts, Needham Heights 02194 Instruments, Incorporated 570 Hillside Avenue	Area Code 617 444-9410
Michigan, Detroit 48220 Ram Meter, Inc. 1100 Hilton Road Ferndale	Area Code 313 547-1000

Minnesota, Minneapolis 55411 Instrumentation Services Inc. 917 Plymouth Avenue	Area Code 612 521-8803
Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 367-9800
New York, Buffalo 14216 Electrical Instrument Labs. 932 Hertel Avenue	Area Code 716 392-2726
N. Y., Great Neck, Long Island 11022 Simpson Instrument Sales & Service, Inc. 130 Gutter Mill Road	Area Code 212 683-0674 Area Code 516 482-3103
New York, Long Island City 11103 A & M Instrument Inc. 48-01 31st Avenue	Area Code 212 726-4343
New York, New York 10011 Electro-Tech Equipment Company 85 Tenth Avenue	Area Code 212 675-2400
New York, Syracuse 13215 Syracuse Instrument Lab. 4895 South Avenue Box 96	Area Code 315 492-1651
New York, Vestal 13850 Compton Industries Inc. 333 Vestal Parkway East P.O. Box 351	Area Code 607 748-3349
North Carolina, Charlotte 28206 Electro-Tech Inc. 3107 Gullman Avenue	Area Code 704 333-0326
Ohio, Cleveland 44135 Weschler Electric Company 4250 W. 130th Street	Area Code 216 251-4609
Ohio, Cleveland 44103 Pioneer-Standard Electronics, Inc. 5403 Prospect Avenue	Area Code 216 432-0010

Ohio, Dayton 45404 SREPCO Electronics Div. of Pioneer Standard Electronic, Inc. 314 Leo Street	Area Code 513 224-0871
Oklahoma, Tulsa 74011 Tri-State Instrument Lab. 3244 East 15th Street, Box 5057	Area Code 918 936-0489
Oregon, Portland 97217 Industrial Instrument Repair Lab. 1910 N. Killingsworth St.	Area Code 503 285-6629
Pennsylvania, Philadelphia 19115 Sunshine Scientific Instrument 1810 Grant Avenue	Area Code 215 673-5600
Texas, Dallas 75204 Ultra Instrument Lab., Inc. 3515 Swiss Avenue, Suite 117	Area Code 214 826-6395 826-6396
Virginia, Falls Church 22046 United Instrument Lab. Inc. 102 W. Jefferson St.	Area Code 703 532-4123
D.C., Washington 20001 Electronic Wholesalers, Inc. 2345 Sherman Avenue N.W.	Area Code 202 483-5200
Washington, Seattle 98119 The Instrument Lab. Inc. 934 Elliott Avenue West	Area Code 206 283-5850
Wisconsin, Milwaukee 53202 Electro-Mechano 261 East Erie Street	Area Code 414 272-4050

WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

ACCESSORY PROBES

H.F.-R.F. PROBE—Part No. 0073 ..... **$ 8.75**

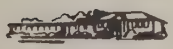
H.V. PROBE—Part No. 0074 ..... **$11.95**

PLAIN OR ROLL-TOP CASE FOR 303 AVAILABLE

Simpson **ELECTRIC COMPANY**

5200 Kinzie St., Chicago 44, Illinois • Phone: EStebrook 9-1121 • Long Distance Dial 312

In Canada: Bach-Simpson, Ltd., London, Ontario



LAC DU FLAMBEAU PLANT
WISCONSIN

LAKE STREET PLANT
CHICAGO

KINZIE STREET PLANT
CHICAGO

AURORA PLANT
AURORA, ILL.

Quality is the indispensable component of every Simpson instrument . . . . . .

Quality is the indispensable component of every Simpson instrument . . . . . .

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

VACUUM TUBE VOLT-OHMMETER
MODEL 303

SIMPSON ELECTRIC COMPANY

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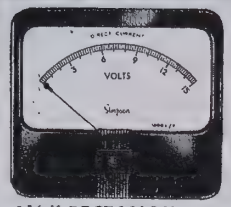
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

Simpson panel instruments...



4½" RECTANGULAR

1375 STOCK TYPES

... plus HUNDREDS MORE, custom-built from standing tools ✻

INSTRUMENTS THAT STAY ACCURATE

✻ Send us your special meter requirements today. Let our top-flight engineers work out solutions or make recommendations *best suited* to your needs.

YOUR ELECTRONIC PARTS DISTRIBUTOR HAS HUNDREDS IN STOCK!

Simpson ELECTRIC COMPANY

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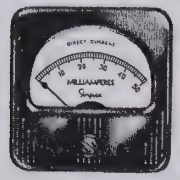
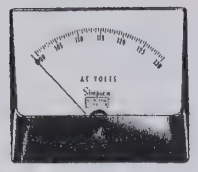


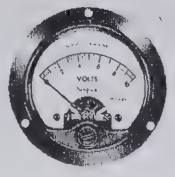
2½ RECTANGULAR
ACCURACY: ±2%

6" RECTANGULAR
ACCURACY: ±2%

See the Simpson ADD-A-TESTER ADAPTERS they will increase the versatility of your 260 or 270 VOM'S.

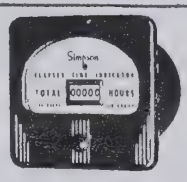


1½", 2½", 3½", 4½"
WIDE VUE
ACCURACY: ±2%



2½" or 3½" ROUND
ACCURACY: ±2%

EDGEWISE
ACCURACY: DC ±2%
SCALE LENGTH: 1⅞"



ELAPSED TIME INDICATOR
110/220 VOLTS

TRANSISTOR TESTER Model 650	$29.95
DC VTVM Model 651	$39.95
TEMPERATURE TESTER Model 652	$39.95
AC AMMETER Model 653	$19.95
AUDIO WATTMETER Model 654	$19.95
MICROVOLT ATTENUATOR Model 655	$19.95
BATTERY TESTER Model 656	$19.95
MILLIOHMMETER Model 657	$44.95
DC AMMETER Model 661	$19.95

WARRANTY

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H.V. PROBE—Part No. 0074	$11.95

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Oregon, Portland 97217 Industrial Instrument Repair Lab. 1910 N. Killingsworth St.	Area Code 503 285-6629
Pennsylvania, Philadelphia 19115 Sunshine Scientific Instrument 1810 Grant Avenue	Area Code 215 673-5600
Texas, Dallas 75204 Ultra Instrument Lab., Inc. 3515 Swiss Avenue, Suite 117	Area Code 214 826-6395 826-6396
Virginia, Falls Church 22046 United Instrument Lab. Inc. 102 W. Jefferson St.	Area Code 703 532-4123
D.C., Washington 20001 Electronic Wholesalers, Inc. 2345 Sherman Avenue N.W.	Area Code 202 483-5200
Washington, Seattle 98119 The Instrument Lab. Inc. 934 Elliott Avenue West	Area Code 206 283-5850
Wisconsin, Milwaukee 53202 Electro-Mechano 261 East Erie Street	Area Code 414 272-4050

OPERATOR'S MANUAL

VACUUM TUBE VOLT-OHMMETER
MODEL 303

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago, Illinois 60644
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

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6-65-ONO-Rev. 4 B&L

Printed in U.S.A.
1-118656

FIGURE 1. SIMPSON VACUUM TUBE VOLT-OHMMETER
MODEL 303

Minnesota, Minneapolis 55411 Instrumentation Services Inc. 917 Plymouth Avenue	Area Code 612 521-8803
Missouri, St. Louis 63112 Scherrer Instruments 5449 Delmar Blvd.	Area Code 314 367-9800
New York, Buffalo 14216 Electrical Instrument Labs. 932 Hertel Avenue	Area Code 716 392-2726
N. Y., Great Neck, Long Island 11022 Simpson Instrument Sales & Service, Inc. 130 Gutter Mill Road	Area Code 212 683-0674 Area Code 516 482-3103
New York, Long Island City 11103 A & M Instrument Inc. 48-01 31st Avenue	Area Code 212 726-4343
New York, New York 10011 Electro-Tech Equipment Company 85 Tenth Avenue	Area Code 212 675-2400
New York, Syracuse 13215 Syracuse Instrument Lab. 4895 South Avenue Box 96	Area Code 315 492-1651
New York, Vestal 13850 Compton Industries Inc. 333 Vestal Parkway East P.O. Box 351	Area Code 607 748-3349
North Carolina, Charlotte 28206 Electro-Tech Inc. 3107 Gullman Avenue	Area Code 704 333-0326
Ohio, Cleveland 44135 Weschler Electric Company 4250 W. 130th Street	Area Code 216 251-4609
Ohio, Cleveland 44103 Pioneer-Standard Electronics, Inc. 5403 Prospect Avenue	Area Code 216 432-0010

Georgia, Atlanta 30310 Electro-Tech Inc. 690 Murphy Ave. S.W.	Area Code 404 758-7205
Hawaii, Honolulu 96817 Electronic Systems Inc. 1622-26 Silva Street	851-457 811-132
Illinois, Chicago 60625 A & M Instrument, Incorporated 4801 North Ridgeway Avenue	Area Code 312 539-4460
Illinois, Chicago 60644 Pacific Indicator Company 5217 W. Madison Street	Area Code 312 261-1330
Illinois, Chicago 60644 Simpson Electric Company 5200 W. Kinzie Street	Area Code 312 379-1121
Kansas, Shawnee Mission 66205 Sturtz Instrument Co. 4705 Mission	Area Code 913 236-4705
Louisiana, New Orleans 70115 Industrial Instrument Works 3305 Tchoupitoulas Street	Area Code 504 895-5621
Maryland, Baltimore 21211 Edgerly Instrument Lab., Inc. 205 West 28th Street	Area Code 301 243-6611
Massachusetts, Cambridge 02138 A. S. Mancib 363 Walden Street	Area Code 617 864-2494
Massachusetts, Needham Heights 02194 Instruments, Incorporated 570 Hillside Avenue	Area Code 617 444-9410
Michigan, Detroit 48220 Ram Meter, Inc. 1100 Hilton Road Ferndale	Area Code 313 547-1000

SECTION I

GENERAL DESCRIPTION

INSTRUMENT

The Simpson Model 303, as shown in figure 1, offers the service and research field a small, compact and rugged vacuum tube volt-ohmmeter, complete in every detail. The high input impedance and frequency response gives this instrument the characteristics necessary in dealing with the high resistance circuits and high frequencies encountered in FM and television receiver servicing.

ROLL TOP MODEL

The Model 303 RT is the same instrument supplied with a convenient, all phenolic, roll top carrying case with a lead compartment sufficiently large to house the leads and line cord.

TEST LEADS

The Model 303 is supplied with a DC test probe, an AC and ohms test probe and a ground lead. An alligator clip is also supplied and may be slipped over the end of the test probe if desired.

POWER REQUIREMENTS

The Model 303 is designed for operation on a nominal 115 volt, 50-60 cycle line.

EXPORT VERSION

220/110 volts, 50-60 cycles (see page 24).

ACCURACY

Accuracy is 3% D.C. and 5% A.C. (60 cycle sine wave) of full scale deflection.

GENERAL DESCRIPTION

ACCESSORY PROBE

A Crystal R.F. Probe may be purchased as an accessory for making R.F. voltage measurements (signal tracing).

ELECTRICAL SPECIFICATIONS

The Model 303 covers seven major functions in the measurement and testing of modern FM and TV receivers and in laboratory and research work, as follows:

D.C. VOLTAGE

Ranges - 1.2, 12, 60, 300, 1200
Input resistance - 10 megohms for all ranges
D.C. Probe - With one megohm isolating resistor
Polarity Reversing Switch

OHMS

Ranges - 1000 (10 ohms center)
100,000 (1000 ohms center)
1 megohm (10,000 ohms center)
10 megohms (100,000 ohms center)
1000 megohms (10 megohms center)

A.C. VOLTAGE

Ranges - 1.2, 12, 60, 300, 1200 volts
Impedance (with cable) approximately 210 uuf shunted by 275,000 ohms.

A.F. VOLTAGE

Ranges - 1.2, 12, 60 volts
Frequency Response - Flat to 100,000 cycles

SIMPSON WARRANTY REPAIR STATIONS AND PARTS DEPOTS

Arizona, Phoenix 85016 Metercraft Inc. 3308 N. 24th St.	Area Code 602 279-6249
California, San Diego 92111 Meter Master, Inc. 8139 Engineer Road	Area Code 714 278-2200
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California, San Francisco 94105 Pacific Electrical Instrument Lab. 111 Main Street	Area Code 415 421-7185
Canada, London, Ontario Bach-Simpson Ltd. 1255 Brydges Street P.O. Box 484	Area Code 519 451-9490
Colorado, Denver 80223 Meter-Master Instrument Service 2145 S. Kalamath Street	Area Code 303 934-4601 934-8614
Connecticut, New Haven 06511 Kaufman Instrument Labs Inc. 810 Dixwell Avenue	Area Code 203 776-7201
Florida, Miami 33136 Florida Precision Instrument Corp. 800 N.W. 7th Avenue	Area Code 305 374-1731
Florida, Orlando 32806 Electro Tech Inc. 307 - 27th Street	Area Code 305 423-5589

EXPORT MODEL TRANSFORMER CONNECTIONS

PRIMARY RATING: 220/110 50-60 CYCLES

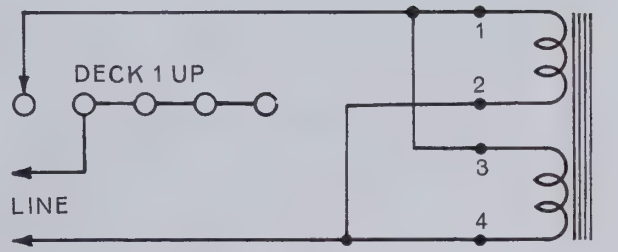


FIGURE 3A. CONNECTIONS FOR 110 VOLTS. OPERATION.

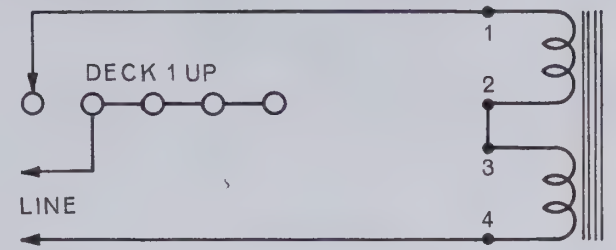


FIGURE 3B. CONNECTIONS FOR 220 VOLTS. OPERATION.

GENERAL DESCRIPTION

DECIBELS

Zero Power Level = 1 milliwatt in 600 ohms
5 Ranges
– 20 to +63 DB

GALVANOMETER

Zero Center for FM discriminator alignment

R.F. VOLTAGE (SIGNAL TRACING)

(With Accessory High Frequency Probe)
Range - maximum 20 volts peak
Frequency - 20kc to 100 mc
Capacity of Probe - 2.5uuf

VOLTAGE MEASUREMENTS DC

DC voltage is measured by applying the voltage through a voltage divider to the grid of one section of a 12AU7 tube. This causes an unbalanced condition between the two sections of the tube resulting in an indication on the meter proportional to the voltage applied.

VOLTAGE MEASUREMENTS AC

AC voltage is measured by applying the voltage directly or through a voltage divider to the plates of a 6AL5 tube where it is rectified and then measured the same as DC.

RESISTANCE MEASUREMENTS DC

DC resistance is measured by applying a voltage from an internal battery to the grid on one section of the 12AU7 tube through a voltage dividing network. This causes an unbalanced condition between the sections of the tube result-

ing in a deflection of the meter proportional to the resistance being measured.

SECTION II

OPERATION

CAUTION

When making high voltage measurements, slip the alligator clip over the test probe and clip the lead to the point under measurement. Always turn off power and discharge capacitors before connecting to or disconnecting from the circuit under test.

ZERO ADJUSTMENT (MECHANICAL)

Before turning on the power to the Model 303, be sure that the pointer is on zero. If pointer is off zero, adjust by means of the slotted screw located in the bakelite case directly below the meter scale. Use a small screwdriver to turn this adjustment slowly right or left until the pointer is directly over the zero point on the scale.

OPERATION OF CONTROLS

CIRCUIT SELECTOR SWITCH

When the CIRCUIT selector switch is in the OFF position, the power is turned off. Turning this switch to the right turns on the power and also selects the circuit to be used. The two positions are marked +D.C.V. and −D.C.V. They constitute a meter reversing switch and indicate the po-

DESCRIPTION

Accessory probe, Part number 0074, is available for use in high DC voltage measurements. It has a multiplier resistor in the probe handle which will increase the total input resistance to 1000 megohms. Basic instrument ranges will increase to 100 times the value marked on the front panel.

OPERATION

Remove the regular DC probe from the "D.C.V." panel receptacle and the ground lead from the "GND" jack. Plug the BLACK elbow connector into the GND. jack of the tester and clip the other end of the lead to the chassis. Connect the cable connector into the panel receptacle marked "D.C.V.". Proceed as for ordinary D.C. voltage measurements, with ranges equal to 100 times the range switch position markings.

RANGE SWITCH POSITION	INSTRUMENT RANGES WITH ACCESSORY H.V. PROBE
12V	0-1200 Volts DC
60V	0-6000 Volts DC
300V	*0-30,000 Volts DC

*Full range indication will be 30,000 volts; this is the maximum allowable voltage for safe operation.

WARNING

Do not apply more than 30,000 volts to the circuit of the High Voltage Probe. Greater voltage may cause irreparable damage to the probe as well as to the instrument.

The crystal diode in the probe body rectifies the voltage under test, charging the .01 uf capacitor proportionate to the positive peak value. This direct current is then fed through a resistor and into the D.C. input of the meter circuit where it is read directly on the scale in R.M.S. values.

To convert meter reading to peak value multiply by 1.414.

OPERATING INSTRUCTIONS

Connect the plug on the end of the cord to the jack marked D.C.V. and set the CIRCUIT selector switch to −D.C.V. Set the RANGE selector switch to the desired range. Connect the alligator clip to a ground connection and touch tip of probe to point being measured.

For the 1.2 volt range read voltage on the red scale marked 1.2 V A.C. ONLY.

For the 12 and 60 volt ranges read the black scale for volts. Note that the limit for voltages is 20 volts peak. This is 14.14 volts R.M.S. on the 60 volt range.

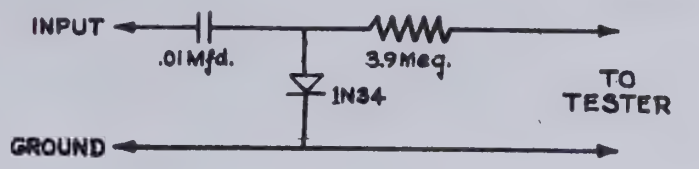


FIGURE 3. HIGH FREQUENCY PROBE FOR SIMPSON MODEL 303, SCHEMATIC DIAGRAM

larity of the D.C. probe lead. This makes it possible to keep the ground lead connected to the chassis or the common connection to read either polarity, and to use the probe lead to check voltages at various points in the circuit.

In the A.C.V. position the circuit is arranged for A.C. voltage measurements through use of a vacuum tube rectifier.

In the OHMS position an internal battery and associated resistors are switched into the circuit to provide for resistance measurements.

The A.C.V.−OHMS probe is used for both A.C. Volts and resistance measurements.

RANGE SELECTOR SWITCH

The RANGE selector switch selects the desired range for the circuit indicated by the position of the circuit selector switch.

ZERO ADJUSTMENT (ELECTRICAL)

After the power has been turned on and the circuit selector switch placed in one of the voltage measuring positions, the knob marked ZERO ADJ. should be turned to the right or left until the pointer is directly over the zero point on the scale. When making this adjustment, the probe being used should be connected to the ground lead. When changing ranges or circuits it may be necessary to readjust zero.

OHMS ADJUSTMENT

With the circuit selector switch placed in the OHMS position and the range selector switch in one of the resistance measuring positions, the pointer will rest near the

right end of the scale (test leads open.) The knob at the right of the meter marked OHMS ADJ. should be turned right or left until the pointer is directly over the last mark at the right end of the scale, the point of infinite resistance.

MEASURING D.C. VOLTAGES

1. Place the circuit selector switch in the +D.C.V. or the −D.C.V. position, depending on the polarity of the voltage to be measured.
2. Rotate the range selector switch to any one of the five voltage positions (1.2 to 1200V) required. While the 303 will not be damaged easily, select a range higher than the voltage to be measured. After the first reading, the switch can be reset to a lower range, if needed, to get a more accurate reading.
3. Plug the ground lead into the jack marked GND. and the D.C. probe lead to the connector marked D.C.V. Connect the D.C. probe tip to the ground lead and rotate the zero adjust control to set the meter pointer directly over the "0" mark on the scale.
4. Connect the ground lead clip to the common side of the circuit under test.
5. Turn on the power to the circuit under test and place the end of the probe on the point to be checked. If desired, slip an alligator clip over the end of the probe and clip it to the point to be checked before power is turned on. If the pointer deflects to the left of zero, the polarity is incorrect; place the circuit selector switch in the other D.C.V. position.
6. Read the voltage on the black arc second from the top, marked VOLTS, reading the figures as follows:

   1.2 volt range - read 0-12 and divide by 10

COUPLING AND BY-PASS CONDENSERS

Inasmuch as a condenser presents low impedance to AC current, readings may be taken on both sides of the condenser and should be approximately the same unless the condenser is defective.

SIGNAL TRACING

The Simpson Volt-Ohmmeter Model 303 is very useful in signal tracing or examining a radio circuit at various points in audio or radio frequency circuits. Its low capacity HF probe permits it to be used on high frequencies found in FM and television work.

SECTION V

ACCESSORY PROBES

HIGH FREQUENCY PROBE FOR MODEL 303 VACUUM TUBE VOLT-OHMMETER

GENERAL DESCRIPTION

Frequency Response	Flat within ±10% from 20 KC to 100 MC
Voltage Range	0 – 20 Max. peak volts
Probe Input Capacity	2.5 $\mu\mu f$
Meter Calibration	R.M.S. value of sine wave
Meter Calibration Accuracy	±7.5% of full scale

The H.F. Probe part number 0073 for the Simpson Model 303 is designed for use on frequencies above the range of the regular A.C. probe furnished with the meter. The cable terminates with the same type of connecting plug.

APPLICATIONS

Model 303 across the AVC network is often more convenient than using an output meter for alignment purposes, as the volume control may be set at its minimum position, and it is not necessary to disconnect the AVC to prevent it from interfering with the alignment procedure.

DISCRIMINATOR ADJUSTMENT

The zero center mark on the dial of the Simpson Volt-Ohmmeter Model 303 permits easy adjustment of a discriminator stage. Connected across the load resistors, the reading will be zero when in balance but will deflect to the right or left if the stage is unbalanced.

FM ALIGNMENT

By connecting the Simpson Volt-Ohmmeter Model 303 across the load resister of the limiter, a reading may be obtained for alignment purposes. Adjust the circuits for maximum indication. Manufacturer's instructions should be followed for exact procedure.

GRID VOLTAGE

The high input resistance of the Simpson Volt-Ohmmeter Model 303 makes it possible to measure voltage at the grids of tubes without excessive loading of the circuit. For example, the output of a local oscillator may be checked throughout the tuning range.

BIAS VOLTAGE

Bias voltages can be read accurately with the Simpson Volt-Ohmmeter Model 303. Its input resistance is so high that when connected across a bias resistor, the additional current drain is negligible.

OPERATION

12 volt range - read 0-12 directly
60 volt range - read 0-60 directly
300 volt range - read 0-300 directly
1200 volt range - read 0-12 and multiply by 100

NOTE: To measure more than 1200 volts D.C. see information on high voltage accessory probe in section V.

ZERO CENTER DC VOLTS

1. Place the circuit selector switch in the position marked –D.C.V. or +D.C.V. With the D.C. probe connected to the ground lead, rotate the ZERO ADJ. knob until the meter pointer is exactly over the red line marked ZERO CENTER.
2. Rotate the range selector switch to a range at least twice the probable voltage to be measured and make connections as for D.C. volts.
3. Observe the indication on the arc of the scale marked VOLTS. Positive voltage on the probe lead will be indicated to the right of center and negative voltage to the left of center with the selector switch set at +D.C.V. Each side represents one-half of the range being used. For example, when the 60 volt range is being used, each half of the scale represents 30 volts and each division 1 volt.

   The purposes for which the zero center scale is used usually do not require an accurate measurement of voltage but merely an indication of a balanced condition. Such a use is illustrated on the alignment of a discriminator where a balanced condition will result in a zero center indication while an unbalanced condition will cause either a positive or negative deflection.

MEASURING A.C. VOLTS

EFFECT OF WAVEFORM

The Model 303 vacuum tube voltmeter is calibrated using a sinusoidal signal. The circuitry is such that it is considered a peak voltage reading type. Since this is the case, the AC and DBM scales are calibrated using effective values based on true sine waves. When it is known that other than sinusoidal signals are being measured, it must be recognized that the accuracy as specified for sinusoidal input will not apply.

MEASURING A.C. VOLTS

1. Place the circuit selector switch in the A.C.V. position.
2. Rotate the range selector switch to any one of the five voltage positions required, from 1.2 to 1200 V.
3. Plug the ground lead into the jack marked GND. Connect the A.C. probe to the connector marked A.C.V. Connect the probe tip to the ground lead and rotate the zero adjust control to set the meter pointer directly over the "0" mark on the scale.
4. Connect the ground lead clip to the common side of the circuit under test.
5. Turn on power for the circuit under test and hold the tip of the probe against the point to be checked. To avoid accidental shock, keep the free hand away from the chassis or any part of the circuit.
6. For the 1.2 volt range, read the voltage on the red arc third from the top marked 1.2V AC ONLY, reading the figures directly. For the other ranges, use the black arc second from the top, reading the figures as follows:

    12 volt range - read 0–12 directly
    60 volt range - read 0–60 directly
    300 volt range - read 0–300 directly
    1200 volt range - read 0–12 and multiply by 100

cuit loading. The following suggestions are only a few of the uses for which it will be found to be a superior instrument.

PLATE VOLTAGE MEASUREMENTS

Inaccurate readings of plate voltage often result when a low resistance voltmeter is used, especially in the case of tube circuits which require high values of plate resistors. Such voltage can be accurately measured with the Simpson Volt-Ohmmeter Model 303, its low current drain resulting in a true reading.

PHASE INVERTER BALANCE

The two sections of a phase inverter circuit may be checked for balance with the Simpson Volt-Ohmmeter Model 303. With an audio signal generator connected to the input of the audio amplifier, the voltages at the grids and plates may be measured.

MEASUREMENT OF STAGE GAIN

The Simpson Volt-Ohmmeter Model 303 is an ideal instrument for measuring stage gain. The output of the signal generator may be checked and the amplified signal then measured at the plate of the tube of the stage being tested. The ratio of the voltage at input and output of a stage represents the stage gain.

AVC VOLTAGE

The use of the Simpson Volt-Ohmmeter Model 303 to measure AVC voltage is possible because the high input resistance of the Simpson Volt-Ohmmeter Model 303 has very little loading effect on such a circuit. Connecting the

MAINTENANCE

Chassis connector (A.C. probe)	10-890063
Chassis connector (D.C. probe)	10-890063
Cable connector (A.C. probe)	10-890066
Cable connector (D.C. probe)	10-890066
Tip Jack (Ground lead)	1-111728
Complete A.C. probe assembly	0068
Complete D.C. probe assembly	0067
Complete ground lead assembly	0069
Case, complete with handle	0-006378
Case, roll top, complete with inside case and handle	0-006379
Meter and panel	15-302303
Power transformer 220/110 V (50-60 cycles) (Export version)	1-117211
Power transformer 115 V (50-60 cycles) (Domestic)	1-119488
Resistor housing	3-260211
Battery 1.5 V	1-111801
Tube, 12AU7 (Aged 3-310744)	1-114083
Tube, 6AL5	1-114084
Carrying handle	3-310874
Selenium Rectifier	1-113619
Line Cord	1-114116

ACCESSORIES

High Frequency Probe	0073
D.C. High Voltage Probe (30KV)	0074

SECTION IV
APPLICATIONS

The high input resistance of the Simpson Volt-Ohmmeter Model 303 permits its use in many applications where a voltmeter of lower sensitivity would cause excessive cir-

OPERATION

VOLUME LEVEL MEASUREMENTS

Connect the Model 303 as for AC voltage measurements.

When using the 1.2 volt range read decibels on the red DB scale.

When using the 12 volt range read decibels on the black DB scale.

When using the 60, 300 or 1000 volt range, use the black DB scale and add to the reading the number of DB appearing opposite the range in the chart directly below the DB scales. The zero power level is .001 watt in 600 ohms. Conversion may be made to the .006 watt–500 ohm level by adding algebraically –7 DB.

RESISTANCE MEASUREMENTS DC

1. Place the circuit selector switch in the position marked OHMS.
2. Rotate the range selector switch to any one of the five ranges required (R x 1 to Rx1MEG).
3. Plug the ground lead into the jack marked GND. Connect the OHMS probe to the connector marked OHMS.
4. The pointer will rest near the right end of the scale (without test leads shorted). Adjust OHMS ADJ. control until meter reads full scale. With leads shorted, meter should read zero (left end of scale). It may be necessary to adjust the ZERO ADJ. knob with leads shorted after which the full scale point should be rechecked with the test leads open.
5. Read ohms on the top arc of the scale marked OHMS. Read the figures as follows:
   Rx1 (1000 ohms) range–read 0–1000 directly
   Rx100 (100,000 ohms) range – multiply by 100
   Rx1K (1,000,000 ohms) range – multiply by 1000
   Rx10K (10,000,000 ohms) range – multiply by 10,000
   Rx1 MEG (1,000,000,000 ohms) range–multiply by 1,000,000

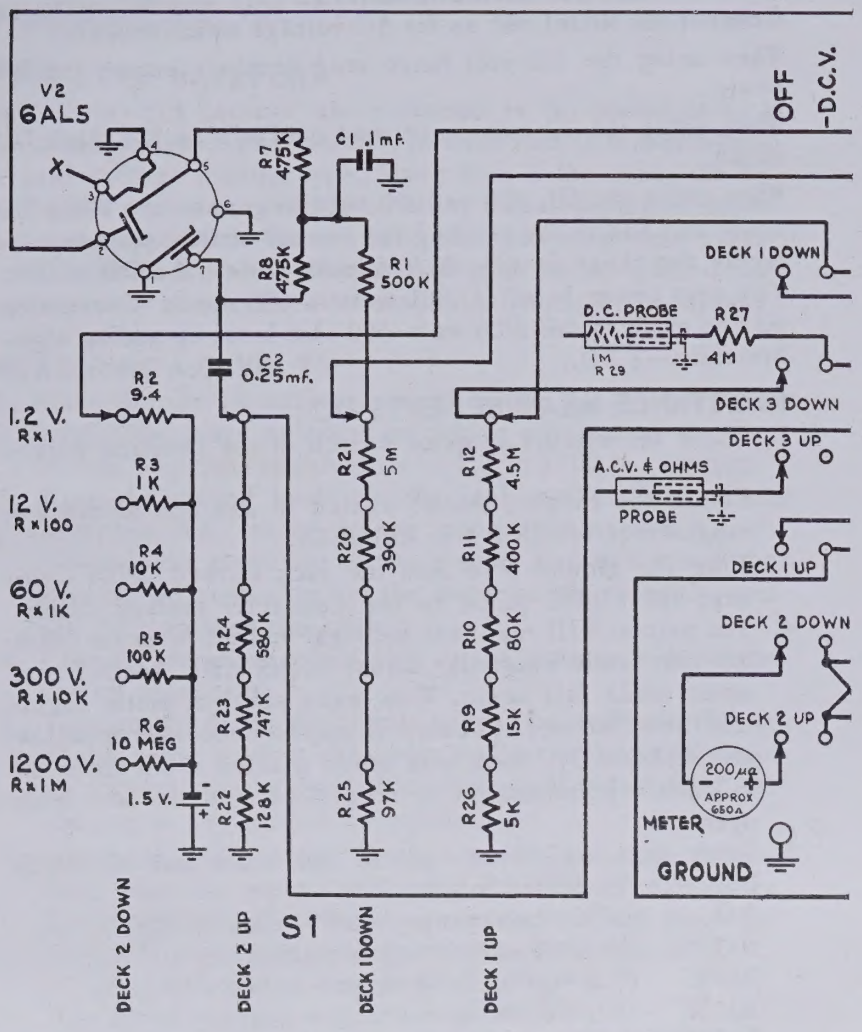


FIGURE 2. SIMPSON VACUUM TUBE VOLT

MAINTENANCE

R15	Resistor, 25K ohms	1-113426
R18	Resistor, 5,700 ohms	1-114198
R19	Resistor, 1 Megohm	1-113392
R20	Resistor, 390K ohms	1-113502
R21	Resistor, 5 Megohms	1-113433
R22	Resistor, 128K ohms	1-114095
R23	Resistor, 747K ohms	1-114096
R24	Resistor, 580K ohms	1-114200
R25	Resistor, 97K ohms	1-114119
R26	Resistor, 5K ohms	1-113425
R27	Resistor, 4 Megohms	1-113362
R28	Resistor, 33 ohms	1-114098
R29	Resistor, 1 Megohm	1-113392
R30	Potentiometer, 1000 ohms	1-114079
R31	Potentiometer, 500 ohms	1-114182
R32	Potentiometer, 1000 ohms	1-114079
R33	Potentiometer, 500 ohms	1-114182
R34	Potentiometer, 500 ohms	1-114181
R35	Potentiometer, 10K ohms	1-114142
R36	Resistor, 25K ohms	1-113426
C1	Capacitor, 0.1 μf, 400 v, paper	1-113902
C2	Capacitor, 0.25 μf, 400 v, paper	1-113903
C3	Capacitor, 0.01 μf, 400 v, paper	1-113896
C4	Capacitor, 20 μf, 150 v, electrolytic	1-114105
S1	Switch, 5 position Range	1-114072
S2	Switch, 5 position Circuit	1-114073
	Knob for S1 and S2	3-260180
	Knob for ZERO ADJ and OHMS ADJ	1-113641
V1	Tube Socket, 9 pin miniature	10-890064
V2	Tube Socket, 7 pin miniature	10-890065

MAINTENANCE

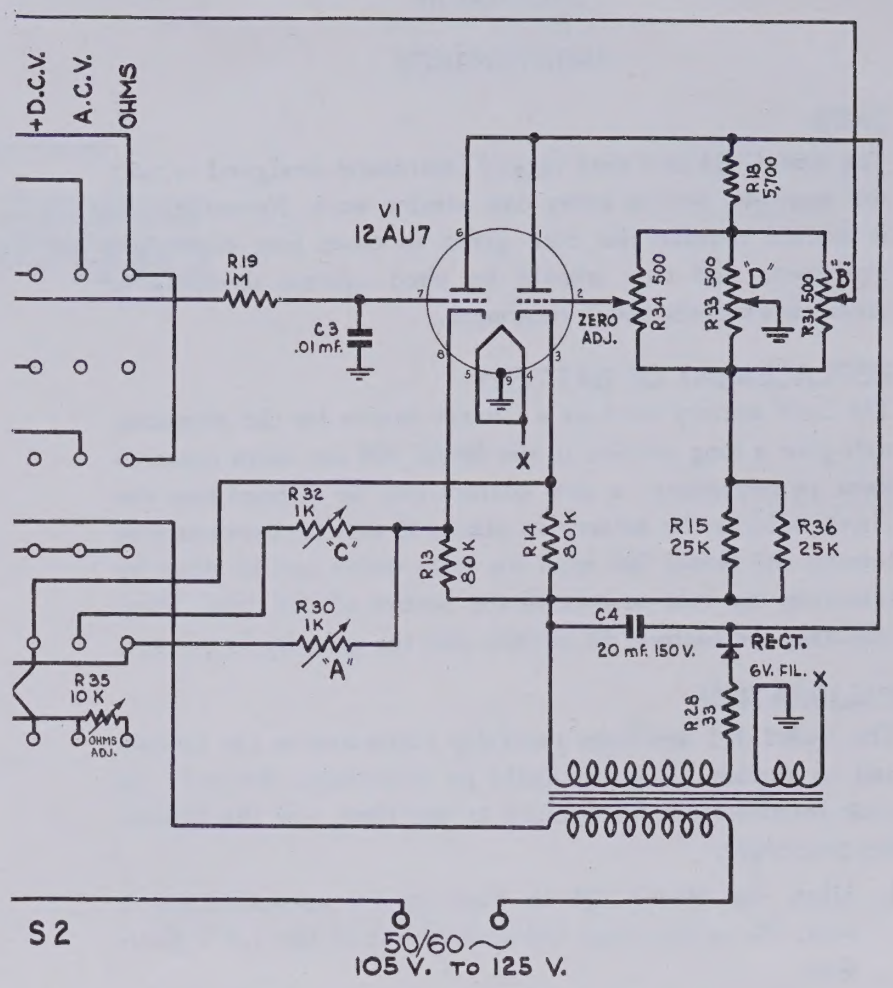
When replacing a tube, it is advisable to use a tube which has been aged for 48 hours (connected in a circuit with a small amount of plate current flowing). If the two sections of the tube vary too much in characteristics, the calibration will be affected; also the zero shift between ranges will be greater than normal.

REPAIR OR PARTS REPLACEMENT

A list of authorized Repair Stations and Parts Depots is shown in the rear of the manual. Contact your nearest Repair Station to obtain service or repair for your instrument. If you wish to order a replacement part, use the Simpson part number and send the order to your nearest Parts Depot.

PARTS LIST

Reference Symbol	Description	Simpson Part No.
R1	Resistor, 500K ohms	1-114090
R2	Resistor, 9.4 ohms	0-008290
R3	Resistor, 1K ohms	1-113542
R4	Resistor, 10K ohms	1-113306
R5	Resistor, 100K ohms	1-113427
R6	Resistor, 10 Megohms	1-113434
R7	Resistor, 475K ohms	1-114180
R8	Resistor, 475K ohms	1-114180
R9	Resistor, 15K ohms	1-113347
R10	Resistor, 80K ohms	1-113313
R11	Resistor, 400K ohms	1-114092
R12	Resistor, 4.5 Megohms	1-114093
R13	Resistor, 80K ohms	1-113313
R14	Resistor, 80K ohms	1-113313



-OHMMETER MODEL 303, SCHEMATIC DIAGRAM

SECTION III

MAINTENANCE

CARE

The Model 303 is a very rugged instrument designed to take the wear and tear of every day service work. Nevertheless, it should receive the care given to other fine electronic equipment and care should be used against dropping or other excessively rough treatment.

REPLACEMENT OF BATTERY

The 1.5V battery used as a current source for the ohmmeter will give a long service in the Model 303 but when replacement is necessary, a new battery can be slipped into the clamp holding the battery in place. It will be necessary to remove the Model 303 from its case which can be done by removing the four screws in the bottom of the case. When inserting the battery, be certain that the polarity is correct.

CALIBRATION

The Model 303 has been carefully calibrated at the factory and no further changes should be necessary. However, in case recalibration is required at any time, use the following procedure:

1. Allow the Model 303 to warm up for approximately 1 hour. Place the range selector switch in the 1.2 V position.
2. Place the circuit selector switch in the −D.C. position. Turn the ZERO ADJ knob to the extreme right and note

the reading on any scale. Then turn the circuit selector switch to the +D.C. position and turn the ZERO ADJ to the extreme left. Note the reading.

If there is any difference between the two readings in the above step, adjust potentiometer "D" (located inside the instrument) until these two readings are approximately equal.

3. Place the circuit selector switch in the −D.C. position. Adjust the ZERO ADJ knob so the meter indicates zero. Place the circuit selector in the A.C.V. position and adjust potentiometer "B" (located on the chassis) until the meter indicates zero.
4. Place the circuit selector switch in the −D.C. position and set the range selector switch to the 1.2 V range. Apply a known D.C. voltage to the D.C. probe which has a corresponding polarity and is within the limit of the range selected. Adjust potentiometer "A" (located on the chassis) until the meter indicates the calibrating voltage correctly. For calibration at the factory, a voltage is selected which will provide about 2/3 of full scale deflection.
5. Place the circuit selector switch in the A.C.V. position and apply a known A.C. voltage to the A.C. probe. Adjust potentiometer "C" (located on the chassis) until the meter indication corresponds to the known voltage.

REPLACEMENT OF TUBES

The 6AL5 tube is used as a rectifier for A.C. voltages. The 12AU7 tube is used in the bridge circuit for all measurements.